

CLIMATE ACTION

Assisting business towards carbon neutrality



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Some call it the sun



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UNEP also calls it solar power

UNEP AND CLIMATE CHANGE: INVEST IN THE GREEN ECONOMY

CLIMATEACTION

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Some call them mangrove forests



UNEP

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UNEP also calls them coastal defences

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We wish to thank...



Ceres

Ceres is a US-based network of investors, environmental organisations and other public interest groups working with companies and investors to address environmental and social challenges such as global climate change. Its mission is to integrate sustainability into company practices and the capital markets to protect the health of the planet and its people. Ceres directs the Investor Network on Climate Risk, a network of more than 60 institutional investors managing more than US\$4 trillion in assets focused on the business impacts from climate change.



The Investor Network on Climate Risk (INCR)

INCR is a network of institutional investors and financial institutions that promotes better understanding of the financial risks and investment opportunities posed by climate change. Much of INCR's focus is aimed at improving corporate disclosure and governance practices on climate change. The four-year-old network, co-ordinated by Ceres, includes more than 60 investor members with collective assets totalling more than US\$4 trillion.



Sustainable Asset Management Risk (SAM)

SAM was founded in 1995 as the world's first asset management company for sustainability investments. Today, the company ranks among the globally leading managers of sustainability investments and theme based funds such as water, climate, clean energy, new materials and healthy living. Its clientele includes banks, insurance companies, pension funds, family offices and private clients.



The Global Compact

The Global Compact is the world's largest voluntary corporate responsibility initiative offering a framework for businesses that are committed to aligning their operations and strategies with ten universally accepted principles. Its 'Caring for Climate' platform provides a framework for business leaders to advance practical solutions and help shape public policy as well as public attitudes on the issue of climate change.



World Business Council for Sustainable Development (WBCSD)

The WBCSD is a CEO-led, global association of some 200 companies dealing exclusively with business and sustainable development. The WBCSD's Energy and Climate project helps companies reduce the impact of their operations and prepare for a carbon-constrained future by exploring energy frameworks, sources, and technologies while also devising practical mechanisms, measurement tools, and market-based solutions.



The World Climate Summit

The World Climate Summit is the business and finance conference accelerating solutions to climate change during the UNFCCC COP 16, in Cancun, Mexico this December. This exclusive conference is a new open and collaborative platform where we will convene the most inspiring, influential and innovative business, finance, and government leaders to collaborate, implement, and scale solutions locally and globally over the next 10 years.



OLADE

OLADE, was created within the context of the international energy crisis of the early seventies with the signing of the Lima Agreement, the constituent instrument of the organisation, ratified by 26 countries in Latin America and the Caribbean. OLADE is the political and technical-support organisation by means of which its member states undertake common efforts to achieve integration and development in the regional energy market.



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Foreword



Achim Steiner
UN Under-Secretary General and UN
Environment Programme (UNEP)
Executive Director

In advance of the UN climate convention meeting here in Cancun, UNEP convened well over 20 leading climate modelling centres and research institutes in order to assess how far the world has moved towards keeping a global, 21st century temperature rise below 2 degrees Celsius.

The findings are both cause for optimism and for concern: if all nations pledges are met in full and supported by sufficient climate financing for example, then it is possible that around 60 per cent of what is needed up to 2020 could be delivered.

This would leave a gap of around five Gigatonnes (Gt) of CO₂ equivalent that must be bridged if emissions are to peak and then start falling sometime in the next ten years.

Five Gt represents around five times the current emissions of international aviation and shipping combined or is equal to the global road transport emissions from cars, buses and trucks in 2005.

Without any action at all, it is likely that a business-as-usual scenario would see emissions rise to an average of around 56 Gt of CO₂ equivalent by 2020.

The report also underlines the complexity of the calculations; the importance of the rules underpinning the implementation of the pledges and thus the central role of the negotiations under the UN Framework Convention on Climate Change (UNFCCC).

Indeed, if only the lowest ambition pledges are implemented, and if no clear rules are set in the negotiations, emissions could be around 53 Gt of CO₂ equivalent in 2020 – that's not that different from business as usual.

In this case global emissions would not fall, but may continue to rise with the possibility of temperature increases of well beyond 2 degrees Celsius, becoming a far more likely reality, and efforts to avoid such a potential catastrophe becoming too expensive to contemplate.

Clearly the rules set in the negotiations matter as much or almost as much as the pledges – rules covering, for

example, the way Land Use and Land Use Change and Forests (LULUCF) is calculated in terms of emissions and credits; the way nations address countries' surplus emissions and how they ensure 'double counting' of offsets is avoided.

Thus Cancun is not just a staging post to the UN climate convention meeting in South Africa in 2011 but an important piece in the jigsaw puzzle en route to a new, global climate agreement.

Cancun is also an opportunity to move forward on Reduced Emissions from Deforestation and forest Degradation (REDD and REDD+) by making this mechanism operational in advance of the UN's International Year of Forests.

Close to 20 per cent of current emissions are linked with deforestation: dramatically reducing the rate can also deliver multiple green economy benefits including improving water supplies; stabilising soils; recycling nutrients important for agriculture and reversing the rate of loss of biodiversity.

Moving ahead on forests is also a key adaptation action, perhaps opening up opportunities for bringing other ecosystems into play. UNEP, with funding from the Global Environment Facility and in partnership with scientists, is currently part way through the Carbon Benefits Project. In China, Kenya, Niger and Nigeria, this is assessing how different land management regimes can contribute to not only sustainable agriculture and livelihoods, but also sequestration of carbon into soils and vegetation.

It is a first step towards bringing other terrestrial ecosystems into carbon markets or part of new funding mechanisms.

And what about marine ecosystems? By some estimates, salt marshes, mangroves and sea grasses are absorbing and locking away up to half of the world's transport emissions.

The overarching challenge must be to reduce CO₂ – the main greenhouse gas which can persist in the atmosphere for centuries. There are multiple opportunities here if governments can unleash the markets towards investments in, for example, renewable energies such as wind or solar,

smarter electricity grids, and more sustainable forms of transport and pay greater attention to energy efficiency in new and existing buildings, for instance.

UNEP is spearheading a campaign, '30 ways in 30 days', showcasing projects where public and private partnerships are catalysing low carbon, resource efficient Green Economy transitions. The campaign is also spotlighting how emerging economies are developing solutions towards adapting their economies to the climate change already underway.

- Prosol is a partnership between UNEP, the Italian Ministry for Environment, Land and Sea and Tunisia's National Agency for Energy Conservation aimed at expanding the market for solar hot water heaters. It has helped more than 105,000 Tunisian families get their hot water from the sun, based on a novel system of lending over US\$60 million.

Over 40 suppliers and more than 1000 installation companies have sprung up to service the market. An average four-person household with an electric water heater is responsible for producing about eight tonnes of CO₂ emissions annually – almost double that generated by a typical modern automobile – while a solar water heater can save the cost and emissions of 12 bottles of liquefied petroleum gas (LPG) every year.

- In Kenya, UNEP, with funding from the Global Environment Facility has assisted the local power company with new drilling techniques in order to reduce the risks of exploring for geothermal power and increase the size of electricity generating wells.

The work has assisted in Kenya's expansion of geothermal – aimed at bringing the output of power from the main plant north of Nairobi from the current 150 MW up to 430 MW, or almost 40 per cent of Kenya's annual requirement while triggering interest among other countries along the Great Rift Valley including Djibouti, Ethiopia and Uganda.

The success of many of these projects is often linked to the catalytic impacts of the carbon markets developed under the UN climate convention treaty alongside the adoption of smart market mechanisms such as feed-in tariffs.

UNEP's overarching Green Economy work, which will lead to a landmark report to be launched at the UNEP Governing Council/Global Ministerial Environment Forum in February 2011, is bringing together many of these market-empowering mechanisms and intelligent incentives in order to further catalyse a transition to a low carbon path.

Sometimes small-scale initiatives can bring about significant change, specially, if scaled up. During the opening of the 65th session of the UN General Assembly, UNEP joined the Global Alliance for Clean Cook Stoves building on eight years of scientific work on the Atmospheric Brown Cloud.

The alliance, announced during the Clinton Global Initiative forum and spearheaded by the UN Foundation, aims to phase-out around three billion inefficient cook stoves using fuels such as biomass, dung and other wastes. Emissions from these stoves are linked with the deaths of over 1.6 million people a year while also contributing to pressure on forests for fuel wood.

The initiative may also provide some important climate benefits: black carbon, one of the pollutants concerned, is not only a health hazard but can contribute to global warming both via atmospheric impacts and by making glaciers and ice masses darker and more vulnerable to warming.

Black carbon is not the only so called non-CO₂ pollutant linked with climate change. Methane, including emissions from waste rotting in rubbish tips; low level or tropospheric ozone; many of the fluorinated gases used in products such as refrigerants and nitrogen compounds including ones produced from agriculture, may together be responsible for perhaps as much as 50 per cent of current climate change.

Many of them need to be tackled anyway for reasons ranging from health to damage to ecosystems including those in the marine environment. And most have short life-times of days, weeks, months or years when compared with CO₂.

Over the past 18 years, much has been achieved in terms of the science of climate change and the evolution of policies and instruments to combat it including the development of carbon markets and mechanisms such as the Clean Development Mechanism.

New science, including and how it relates to forests and to non-CO₂ pollutants, is widening the lens and the scope for action and when you look around the world, the uptake of clean technologies in many countries is far faster than some may have presumed only a decade ago. Indeed in 2009, new investment in renewables outstripped new investment in fossil fuel generation and nuclear combined according to the UNEP Sustainable Energy Finance Initiative.

Copenhagen did not deliver the decisive, new global agreement that seemed possible and which is urgently needed. But, as the new gap analysis shows, neither did Copenhagen fail. If all the pledges are fulfilled and leadership is shown, then this new climate co-operation between developed and developing countries take the world a long way towards where it needs to be in 2020.

That leadership must evolve onto a higher level in Cancun, Mexico en route to the UN Climate Change Conference in South Africa in 2011. **Cancun must be a time where action on financing, mitigation and adaptation matures and moves forward.**

Above all, Cancun must demonstrate to society as a whole that governments understand the gaps left by Copenhagen, but at the same time remain serious and committed to counter climate change, in order to meet wider development and environmental goals and ensure that the next generation will inherit a productive and functioning planet.

Achim Steiner is UN Under-Secretary-General and Executive Director of the United Nations Environment Programme (UNEP). He has worked both at the grassroots level and the highest levels of international policymaking to address the interface between environmental sustainability, social equity, and economic development.



Oceanlinx

Clean electricity from ocean waves

Oceanlinx is an Australian company, with seven global subsidiaries and approximately one hundred international shareholders. Oceanlinx has developed a technology to convert the energy in ocean waves into electricity. The company utilises improvements it has developed in Oscillating Water Column (OWC) technology, coupled with its innovative and proprietary wave energy turbo-machinery system and smart integration, to deliver cost effective and completely emissions-free electricity and desalinated water. The only moving parts are positioned several metres above sea level, thereby eliminating any potential harm to marine life. This zero-emissions system is a completely benign form of renewable energy conversion in every respect.

The Oceanlinx technology has received numerous international awards and accolades, including being named one of the Ten Most Outstanding Technologies in the World by the International Academy of Science in 2006, and ranking third on the United Nations Industrial Development Organization's (UNIDO) list of the Top Ten Renewable Energy Investment Opportunities in the World in 2009. As recently as September 2010, the latest version of the Oceanlinx technology was named the Most Outstanding Clean Energy Technology Innovation at the Annual EcoGen Awards in Sydney, Australia.

Oceanlinx and Mexico's Comision Federal de Electricidad (CFE) are finalising an agreement which will form the basis for the development of CFE's first wholly owned wave generated electric energy project utilising the Oceanlinx technology. The plant, expected to be operating in early 2012, will be located at Rosarito on the northwestern coast of the State of Baja California. Rated at an expected 500 kW, the wave energy plant will result in a meaningful decrease in fossil fuel generation, equivalent to a reduction in emissions of 1500 tonnes of CO₂ into the atmosphere per annum.

Oceanlinx is concurrently developing several wave energy projects in other parts of the world. These include: Portugal, Australia, and the USA.

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In Bangladesh homes have benefited from soft loans so they could install solar-generated electricity.



Pavan Sukhdev
Special Adviser & Head, Green Economy Initiative, UNEP

Towards a green economy

Realising the benefits of building a resource-rich, low-carbon future

Several countries are already demonstrating that there are real economic gains, as well as environmental and social benefits, to moving towards a resource-rich, low-carbon future. However, in order to scale-up these efforts to meet the tremendous challenges of the 21st century, governments – and particularly Finance Ministers and policymakers – will need to create conceptual regulatory and financial frameworks that support this transition. This article explores several practical measures that policy makers can consider and calls on them to help lead the way.

The world urgently needs a new economic paradigm – one that stimulates growth and employment while reducing poverty and environmental degradation. The green economy represents such a strategy.

The good news is that many countries – including some emerging and developing nations – are leading this brigade.

“Every country has its own unique ecological and human assets and challenges, and thus needs to develop its own path to reach the end goal.”

Designed to foster sustainable development, achieving a green economy should be seen as a journey. Every country has its own unique assets and challenges, and thus needs to develop its own path to reach the end goal. But what is imperative is that we all move in this direction.

This is not a revolution but an evolution. So long as we continue to live beyond the means of the planet, consuming its resources faster than it can regenerate them and producing greenhouse gases at rates far greater than it can withstand, we must seek an alternative way forward.

Renewable energy investments are projected to reach US\$630 billion by 2030, up from US\$162 billion in 2009, and to create an additional 20 million jobs.

Policymakers – and Finance Ministers in particular – have a critical role to play in leading this transition. Ultimately, the future economic development path will be shaped by the regulatory and financial frameworks developed to support a green economy.

Furthermore, governments need to ensure that there are substantial investments made that protect and enhance natural capital, and at the same time, minimize any environmental risks or natural resource scarcities.

In a recent technical paper developed by UNEP's Green Economy Initiative entitled, *Driving a Green Economy Through Public Finance and Fiscal Policy Reform*, it makes the following recommendations:

- New substantial investments will need to be supported by a portfolio of policy measures – fiscal, regulatory and informational – to promote an effective and fair transition to a green economy;
- International policies and market infrastructures must also be developed to encourage new investments;
- Tax reforms that improve environmental sustainability should be considered;
- Public expenditure, including for cleaner infrastructure provisions, sustainable procurement and funding for research and development, can also drive market change;
- Lastly, and perhaps most obvious, reforming harmful subsidies, which fuel unsustainable economic activity and environmental degradation might be politically difficult in the short-term but are fiscally advantageous and an important step in moving towards a green economy.

While many governments are still recovering from the global financial crisis, there may be temptation to seek short-term solutions that support 'business as usual' activities and continue to exploit our natural capital. However, such strategies are short-sighted and the challenges before us too great.

Today, we know that escalating climate change is wrecking havoc on already stressed natural ecosystems critical to our survival, such as forests and freshwater.

Increasing human population is also adding to this pressure – not only in terms of resource use, but also in terms of services and infrastructure in our cities, where half of the world's population now live.

Furthermore, ecosystem services, which underpin the global economy, are shrinking at a rapid rate. The world's poor are particularly vulnerable with 14 per cent of the population of developing countries and some 21 per cent of their urban dwellers, living in low-lying coastal regions most exposed to climate risks such as rising sea levels, coastal flooding and soil erosion.

Therefore, we must accelerate our efforts to transition from a wasteful and unsustainable 'brown' economy to a low-carbon, resource-rich 'green' future. We must lessen our excessive dependence on fossil fuels – oil, gas and coal – which still attracts US\$500 billion a year in government subsidies, and scale-up our investments in renewable energy technologies, such as wind and solar power.

Trends in sustainable energy investments are continuing to grow, surpassing investments in fossil fuel generation in 2008. Globally, renewable energy investments are projected to reach US\$630 billion by 2030, up from US\$162 billion in 2009, and are expected to create an additional 20 million jobs.

What some may find surprising is that so many emerging and developing economies are already deriving benefits from moving towards a green economy. In China, India, Brazil and South Africa, as well as in Bangladesh, Barbados, Papua New Guinea, Kenya and Uganda – governments are already pursuing green economic initiatives that will help their countries meet these challenges.

Smart buildings and smart grids, introduced with the appropriate policy measures, help improve urban efficiency.

- Curitiba, Brazil, where I visited recently to launch the *TEEB for Local & Regional Policy* report, is considered a world-class model in urban planning and especially public transport – 45 per cent of the city travel is in the public network. The designers' foresight and perseverance have paid off as the city's population and industry have expanded over the years, along with its public green space. Now, it also has the highest public green space of any metropolis.

Smart buildings and smart grids, introduced with the appropriate policy measures, help improve urban efficiency.

- In Kenya, the government has been extremely innovative. It has introduced feed-in tariffs, which require energy companies responsible for the national grid, to buy electricity from renewable energy sources at pre-determined prices that are high enough to encourage new investment, while providing a

guaranteed market for those producing the electricity from solar, wind and other renewable sources.

- In Bangladesh, despite the fact that more than 80 per cent of the population lives in poverty and 70 per cent have no access to the electricity grid, more than 300,000 homes have benefited from soft loans offered by a Grameen Bank subsidiary so they could install solar-generated electricity. This means rural families – and particularly women and children – no longer endanger their health using polluting kerosene lamps.
- In China, now the world's largest exporter of solar panels, 10 per cent of the households now have solar-powered water heaters, and 1.5 million people are employed in its renewable energy sector.

☞ *In Bangladesh more than 400,000 homes now have solar photovoltaic lighting based on microfinance from Grameen Shakti.* ☞

Other countries, like Barbados and South Africa, are also part of this economic transformation.

- Barbados first highlighted its green economy aspirations in its National Strategic Plan in 2006, and has recently asked UNEP to undertake a scoping study to help it advance its work in key sectors so it can meet its goals. The results will be unveiled at a regional conference on the green economy in the spring of next year.
- South Africa is also seizing this opportunity, and is keen to develop a regional green economy strategy for the continent.

Several countries are demonstrating that multiple benefits can be realised as a result of promoting new green sectors, as well as from greening the traditional brown sectors. For example, certified biodiversity-friendly agricultural products are expected to be worth US\$210 billion by 2020, up from US\$40 billion in 2008. With the right backing, this sector can generate new income flows while conserving the planet's natural capital.

- In Uganda, where 85 per cent of the population is employed in agriculture, the first national Organic Standard was adopted in 2004. A few years later, under a joint initiative by UNEP and UN Conference on Trade and Development (UNCTAD), the East African Community adopted a similar measure, called the East African Organic Products Standards. During this period, certified organic exports jumped from US\$6.2 million in 2004/05 to US\$22.8 million in 2007/08. In 2009, the government released a draft Organic Agriculture Policy, which provides new mechanisms for individual farmers to improve productivity and access markets, and thus, helps to secure the country's future growth in this sector.

Policymakers need to provide better and more transparent regulations that level the playing field and enable new models and green products to compete. At the same time, closer collaboration with the private sector could encourage innovation and sustainable production.

- In India, numerous examples of public-private partnerships are underway, but more resources and corporate sector support are needed if the country is to take full advantage of these opportunities. In the clean energy sector, for example, the UN predicts that India stands to gain 900,000 new jobs in the area of biogas alone. From empowering rural communities to creating new incentives for innovation, India is certainly considered a key partner on this journey.

The financial crisis sparked green investments in government stimulus packages. The Republic of Korea, for example, pledged 3 per cent of its GDP or up to 80 per cent of its total stimulus package to green initiatives, while the UK pledged 6 per cent of its stimulus package would be set aside for green measures. Currently, though, the green portion of the G20's US\$2.7 trillion stimulus package only adds up to a mere 0.7 per cent of its GDP. This means that these countries are falling short on their commitment to a 'green recovery and to sustainable global growth.'

While many countries are already demonstrating that there are multiple opportunities and benefits in moving towards a green economy, the onus is on policymakers, and particularly Finance Ministers, to create new conceptual regulatory and financial frameworks that will help lead and support this critical transition.

There has never been a better time to promote this new economic paradigm – one that ensures countries are well-positioned to make the transition to a green economy and reap its many rewards.

Pavan Sukhdev is Special Adviser and Head of UNEP's Green Economy Initiative. He is also the Study Leader for the The Economics of Ecosystems and Biodiversity (TEEB), a project he was appointed to lead in 2008. A career banker, Pavan is on sabbatical from Deutsche Bank to lead these projects.

UNEP's Green Economy Initiative is designed to assist governments in 'greening' their economies by reshaping and refocusing policies, investments and spending towards a range of sectors, such as clean technologies, renewable energies, water services, green transportation, waste management, green buildings and sustainable agriculture and forests.

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VALE:

Leadership in managing climate change



Global mining company, VALE, headquartered in Brazil, is the world's biggest producer of iron ore and pellets. It has a presence in over 30 countries and a workforce of over 100,000. It is a global leader in nickel production – used in making stainless steel, batteries, special alloys and other products – as well as producing copper, manganese, potash, bauxite, aluminium and coal among other raw materials vital for industry.

The company is recognised worldwide as a pioneer in sustainable mining. VALE's investment in social and environmental projects over the last five years has increased by nearly 400 per cent, totalling US\$2.9 billion. The company's mission to transform mineral resources into prosperity and sustainable development guides all aspects of its business, from strategic planning and risk management down to its daily operations. The company believes it has a responsibility to seek sustainable development wherever it operates and manage the potential environmental impacts of its activities.

VALE is committed to cutting its CO₂ emissions. In 2008, VALE established the VALE Carbon Program, a wide-ranging set of globally-coordinated measures aimed at achieving standards of excellence in climate change action by 2012. Its objectives include: the strategic evaluation of climate change impacts on business; the fostering of green house gas (GHG) emissions reduction and CO₂ sequestration initiatives; cooperation and partnership for research and development (R&D), and engagement with governments and the private sector to prepare for future climate change regulation.

In 2009, the company launched the Open Letter to Brazil on Climate Change, in partnership with the Ethos Institute and the Sustainable Amazonia Forum, which was signed by 30 large Brazilian companies. The signatories made voluntary commitments to contribute to mitigating the impacts of climate change and put forward suggestions for the participation of the Brazilian government in the 15th Conference of the Parties of the United Nations on Climate Change (COP15).

VALE also contributes to the regulation of Brazil's National Policy on Climate Change, which became a federal law in December 2009, incentivising businesses to reduce emissions through the use of low carbon intensity technologies.

The company produces annual carbon emission reports following GHG Protocol guidelines which are audited

by independent parties through the Carbon Disclosure Project (CDP). Its transparency in emissions disclosure has been recognised by the market. In Goldman Sachs' July 2009 report on climate change, VALE was named a world leader for its emissions management.

Biofuel and water recycling

VALE is working on biofuel generation from palm oil in partnership with Biopalma Amazonia SA with the aim of producing biodiesel from 2014.

The biodiesel will be used to power a fleet of 216 locomotives and the heavy machinery used in the company's Carajás mines. The switch from diesel oil to biodiesel will reduce CO₂ emissions by 12 million tons of CO₂ during the 25-year lifetime of the project – equivalent to the emissions from more than 200,000 cars over the same period.

In March this year, Vale began using a new technology in the same iron ore mines to make use of moisture drawn from within the mines for sifting rather than using fresh water sources. It will cut annual water consumption in the mines by the equivalent of that used by a city of 430,000 inhabitants and significantly cut energy use.

Worldwide recognition

Vale was rated as one of the five most sustainable companies in the sector of basic materials in the 2009 Goldman Sachs GS-Sustain report.

In 2009, Brazilian news magazine, *Época*, awarded Vale its annual Climate Change Prize as a Brazilian company with most outstanding climate change policy. In September 2010, Vale received the *Época* Prize for the Best Climate Change Strategy in the Industry.

In June 2010, Vale's GHG inventory was the only mining company to receive the gold seal from the Brazilian GHG Protocol Program.

Furthermore, according to the results of the 2010 CDP report, Vale is the only Brazilian company listed in the CDLI (Carbon Performance Leadership Index).

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We will be kick-starting an energy efficient overhaul of home and businesses across the country.



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Greg Barker
Minister of State for Climate Change, UK

The Green Deal:

Financing energy efficient buildings across the UK

Britain's coalition government has proposed the country's most ambitious energy efficiency drive to date, promising to insulate millions of homes and workplaces nationwide under a new 'Green Deal'. The innovative Deal will unlock private investment to cover the upfront costs of improving Britain's ageing, energy-inefficient housing stock which will then be paid back by householders from the savings made on their energy bills.

There's a clear recognition in the new coalition government that tackling climate change, securing our future energy supplies and making a permanent transition to a low-carbon, high-growth economy is an urgent and vital task.

Energy efficiency lies at the very heart of our strategy. It means being smarter about the energy we use – making the most of a precious resource and eliminating waste.

But it's also a policy that's long been ignored – with homes and businesses across Britain wasting energy and money.

The Green Deal

The UK government's Green Deal is about providing a long-term solution to this intractable problem. It's the biggest shake-up in the history of energy efficiency. It will be more ambitious than anything that's ever been tried before. It will reduce energy wastage and save people and business money. It will create jobs, reduce CO₂ emissions and help secure energy supplies for future generations.

“The Green Deal will be a bigger national drive than putting on the London Olympics.”

The idea is to get high-street companies people already know to provide the finance for trusted and accredited advice, and installation of energy efficiency measures in homes and businesses. Customers benefit from homes and business premises that are cheaper to run from day one.

Through legislation to be presented to Parliament before Christmas, we want the finance to be tied to the energy meter. People will pay back the costs over time through their energy bills, with the payments being less than the savings on bills.

The Green Deal will be available whether people own or rent and, because it's not like personal debt, personal credit ratings are not a factor.

The potential

The Green Deal will be a bigger national drive than putting on the London Olympics. Just as the Games are closing in 2012, we will be kick-starting an energy efficiency overhaul of homes and businesses across the country.

The Green Deal has the potential to support up to 250,000 jobs by 2030 as part of a new energy efficient industrial revolution. Insulation installers and others in the retrofit supply chain all stand to benefit from this long overdue energy efficiency makeover. So it's important that the insulation and construction industry can prepare their workforces with the appropriately skilled people to provide the quality installations and services the Green Deal will demand.

And with millions of British homes and businesses requiring insulation, the Green Deal also offers a unique opportunity to help drive economic growth, unlocking billions of private investment every year.

So how does it work?

With homes accounting for a quarter of all CO₂ emissions, and energy bills in UK households standing at an average of UK£1,300 per year, improving energy efficiency and reducing bills in the process is a no brainer.

“The Green Deal also offers a unique opportunity to help drive economic growth, unlocking billions of private investment every year.”

The Green Deal will make it as easy and as financially attractive as possible to do work like lagging lofts, filling in wall cavities and taking further steps to reduce energy use in the home.

And it will work in the same way for businesses, irrespective of size, by offering the opportunity to improve things like heating and lighting without needing to meet these costs upfront.

But we need legislation to make this happen. The Energy Security and Green Economy bill will be introduced by the end of 2010 to legislate so that payment

of the costs can be made through a charge on the energy bill. Households and businesses would only pay while occupying the property and enjoying the benefits.

In parallel, we'll also ensure that the major energy companies remain obliged to invest in energy improvements for homes across the country. This means that, for the poorest and most vulnerable, or those living in properties that are particularly hard to treat, there'll be extra support to help people benefit from the measures that the Green Deal has to offer.

“This is a dynamic new market which we're determined not to lose out on.”

Importantly, better insulation means less energy is needed to heat the building, meaning lower costs for households and businesses, helping to cushion everyone against the rising energy prices we have seen of late.

What's next?

Just as the organisers of the Olympic Games are furiously working to ensure the venues and infrastructure are in place for 2012, we are doing exactly the same with the Green Deal.

We're now pressing ahead with legislation to create the right framework in which companies can invest the new capital necessary to meet the scale of the challenge.

The Green Deal – due to come into force in Autumn 2012 – will set in train a radical change in Britain's energy efficiency, and could bring the green economy into every home and business. This is a dynamic new market which we're determined not to lose out on.

Greg Barker is Energy and Climate Change Minister for the UK coalition government. He was first elected as a Conservative Member of Parliament in 2001 and was made shadow Environment Minister in 2005. He has since been working closely on climate change and environmental policy. After serving as shadow Climate Change Minister for the newly-created Department of Energy and Climate Change (DECC), he was appointed Minister of State for Climate Change this year. He has been a key contributor to several policy papers on low-carbon and green energy and, prior to his appointment as Climate Change Minister, was closely involved in developing the UK's Climate Change Act in 2008.

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Sean Ebnet
Director of New Business



‘Field to Furnace’ – measuring the carbon footprint of biomass fuel

Biomass energy has a vital role to play in the efforts to combat climate change and transition global energy production to less carbon intensive technologies. Biomass fuels are diverse and plentiful while the associated combustion technologies are well-proven and commercially available. Unlike most other large-scale renewable technologies, biomass-fired generation can respond flexibly and quickly to changes in electricity supply or demand and provide reliable, predictable power, thereby complementing seasonal and intermittent technologies such as wind, solar and hydroelectric power.

“When transporting large volumes of material the distance travelled is far less important than the mode of transportation.”

Stalks, leaves, branches, husks, shells, grasses, sawdust, woodchips – biomass comes in many forms. Indeed, it comes as a surprise to some that biomass is the fourth largest energy resource in the world after oil, coal, and gas. The International Energy Agency (IEA) estimates that by 2050, sustainable biomass could supply up to 20 per cent of the world’s primary energy requirements.

Although biomass is a plentiful and commercially proven source of renewable energy, its carbon neutrality is

the subject of some debate. While it is accepted that the combustion of biomass emits only the same quantity of CO₂ as is captured by its growth, a more comprehensive analysis is still required to properly address carbon emissions over the whole lifecycle. This includes emissions associated with the cultivation, harvesting, processing and transportation of that biomass material through to its combustion. Other key factors that also need to be assessed include:

- 1) whether the production of that biomass results in a change in land use;
- 2) how much and what type of energy was used to process the biomass (e.g. pellet production);
- 3) whether the biomass material was a residual by-product of another industry such as food crops and lumber harvesting or was it purposely grown as a fuel (e.g. energy crops).

It has long been maintained by energy experts, such as the IEA and the International Panel on Climate Change (IPCC), that properly managed forest biomass resources are carbon neutral in terms of energy generation. This is based on the presumption that, over a long period of time, more CO₂ will be recaptured in growing forests than was emitted during combustion, thereby resulting in lower net CO₂ emissions. In fact, the actual atmospheric greenhouse gas implications of burning forest biomass for energy are more complex. The issues to be considered include: the technologies used in electricity generation; the efficiency of the generation; the fossil fuel that is being replaced;



the environment in which the biomass is cultivated and harvested; the forest management techniques used; any resulting changes in land use; and the period of time over which the GHG implications are examined.

Establishing a lifecycle emissions standard for biomass is a transparent way of demonstrating the true carbon savings of electricity generated from biomass. At Drax we call this a ‘Field to Furnace’ assessment. Specifically, we require that 100 per cent of our biomass fuel passes a rigorous analysis of its lifecycle CO₂ emissions across the supply chain, from harvesting and cultivation through combustion. Further, we also stipulate that all of the biomass fuel we purchase delivers a CO₂ reduction of at least 70 per cent over the Drax coal-fired plant, currently the most efficient such plant in the UK. The European Union and UK government are both targeting a similar reduced CO₂ standard of 285kg CO₂/MWh (carbon dioxide per megawatt-hour), for biomass generation, compared to the European fossil plant average of 713kg CO₂/MWh.

Our ‘Field to Furnace’ assessment also underpins the importance of selecting markets, suppliers and fuels that best fit the scale and technology of a particular project. There are three areas where the lifecycle CO₂ emissions analysis of biomass takes place:

1. The field (planting, cultivation and harvesting)

At Drax we seek to source as much of our biomass material as we can locally. However, the limited land mass and large demand for renewable energy in the UK requires us to take a global approach to sustainable fuel sourcing. We also believe it is important to maintain diversity in our biomass fuel portfolio and not overburden any one market for all our fuel needs. While the production and diversity of biomass fuels available for energy production is enormous, many of these fuels are wastes or by-products of other existing industries.

For example, forestry lands are managed primarily for lumber production and agricultural lands are primarily managed for higher value food crops. The secondary products from these operations – such as tree tops and branches, bark, and thinnings from forestry and by-products such as straw, seed husks, and bagasse from agriculture – are usefull biomass fuels. Utilisation of these materials for power generation ensures an effective use of their intrinsic carbon. Residual materials that are wastes or by-products of other primary industries, offer additional greenhouse gas (GHG) reduction benefits in that the lifecycle GHG assessment generally demonstrates little or no additional emissions for their planting, cultivation and harvesting.

2. The supply chain: processing and transportation

The most efficient and convenient means of bulk transportation, storage and handling of biomass involves removing excess moisture and compressing the material into a dense pellet as near to the point of origin as possible. The additional costs and CO₂ emissions associated with this pellet-making process are taken into account in the overall lifecycle emissions assessments but are typically offset by reduced transportation/handling costs and decreased GHG emissions, which in turn can provide an overall benefit in terms of the lifecycle emissions. It is also common to find pellet processing facilities that utilise a portion of the biomass fuel to run some of the more energy intensive processing equipment.

“ When sourced sustainably, electricity generated from biomass can achieve significant carbon savings over the least carbon intensive fossil fuel plant. ”

When transporting large volumes of material the distance travelled is far less important than the mode of transportation. As illustrated in Figure 1, bulk marine transportation is the least carbon intensive mode of transportation available. This is because of the substantial volume of material that can be transported

Figure 1. Shipping costs: cash and carbon.

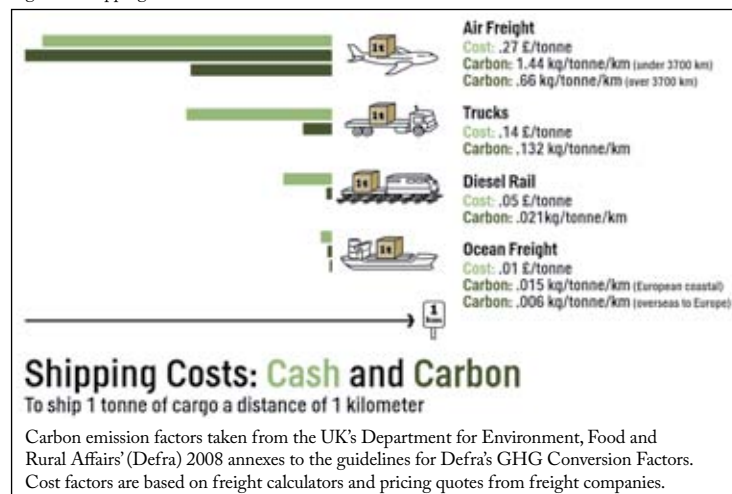
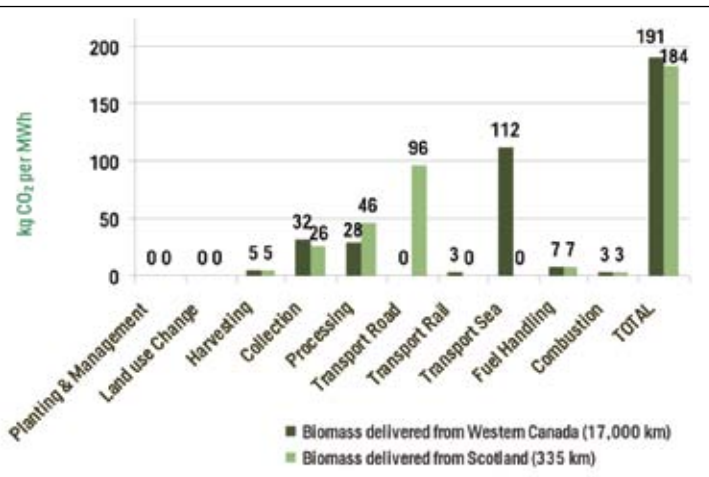


Figure 2: Greenhouse gas comparison of imported versus domestic biomass.

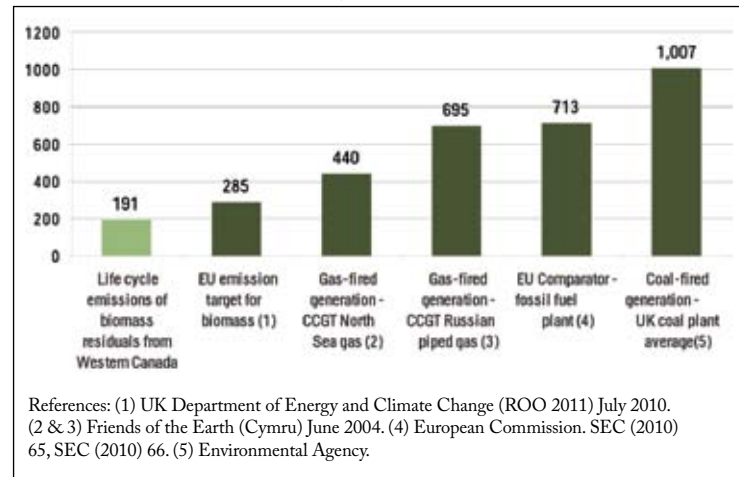


by each ocean-going vessel. For example, the electricity produced by Drax using biomass pellets that have been transported 17,000 km from Western Canada to the UK would generate a total carbon footprint of 191kg CO₂/MWh. A similar assessment conducted for the electricity produced by the same volume of biomass, but this time transported by truck a distance of 335 km from Scotland to the Drax power station in North England, (returning empty), would generate a total carbon footprint of 184kg CO₂/MWh. The breakdown of these two examples is shown in Figure 2. Despite the transportation distance being over 25 times greater from Western Canada than from Scotland, the lifecycle GHG emissions from the delivered biomass are similar. Such analysis underpins the investment Drax is making in specially designed rail wagons to increase volume stowage and further reduce the environmental impact of domestic logistics.

3. The furnace (fuel handling and combustion)

The final stage of converting biomass material into electrical energy involves transferring the fuel from storage to the boiler, combusting the biomass to generate steam which drives the turbines and then disposing of the ash. The relatively small amount of GHGs emitted in this stage are from milling the biomass pellets into finer particles and the small amount of GHGs emitted from the stack during the combustion. It is at this final stage that the benefits of predictable around-the-clock generation can be realised. Biomass generation is one of the few large-scale renewable technologies that can effectively substitute non-renewable generation (from gas, coal and provide important baseload support to other intermittent and seasonal forms of renewable generation (wind, solar, wave and small hydro).

When using methodologies for assessing the lifecycle impacts of biomass, it is appropriate to set the resulting data in the context of emissions from other demand-driven generating technologies. As illustrated in Figure 3, these values are 440-695 and around 1,000kg CO₂/MWh of electricity produced, for gas- and coal-based generation respectively. In this example, it is clear that even when assessing lifecycle emissions associated with importing biomass from the Pacific Ocean to

Figure 3: Fuel life cycle emissions (in kg CO₂/MWh).

References: (1) UK Department of Energy and Climate Change (ROO 2011) July 2010. (2 & 3) Friends of the Earth (Cymru) June 2004. (4) European Commission. SEC (2010) 65, SEC (2010) 66. (5) Environmental Agency.

the UK, the use of that biomass still offers undeniable benefits as an alternative to existing fossil fuel generation technologies.

Sustainability throughout the supply chain

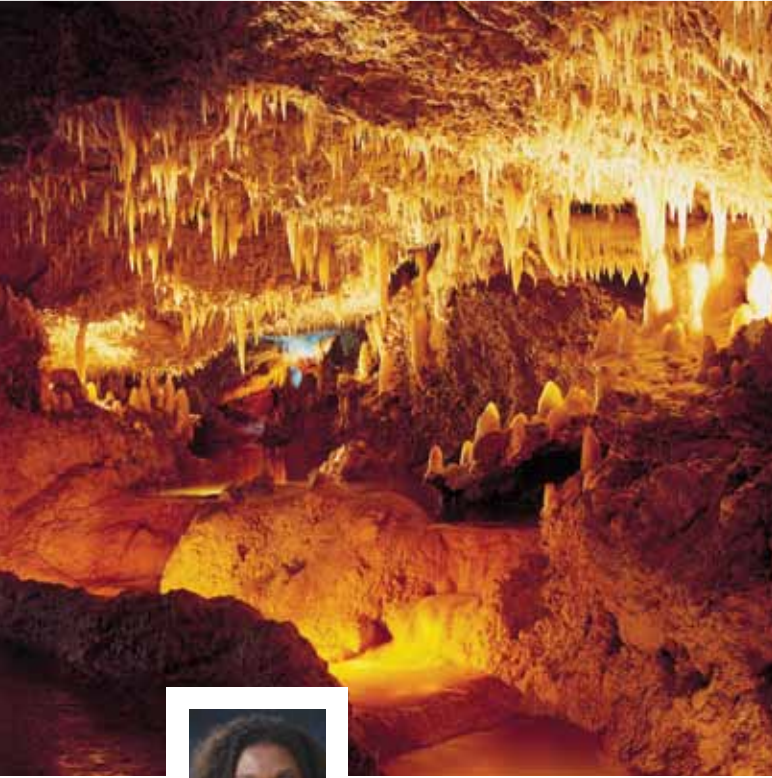
Regardless of whether biomass fuel is foreign or domestic, the fact remains that when sourced sustainably, electricity generated from biomass can achieve significant carbon savings over the least carbon intensive fossil fuel plant. The many benefits of biomass are also an ideal fit for markets such as the UK where security of supply, firm capacity and renewable energy are all key objectives.

Biomass is a diverse, well-proven and plentiful fuel source but it is not without its challenges. We cannot take its carbon benefits for granted. There is also more to biomass sustainability than simply measuring the GHGs of fuel across a supply chain. At Drax additional emphasis is placed on implementing a wide-ranging set of environmental, social and ethical principles and work proactively with our suppliers to ensure best practices are followed. The effort to combat climate change is a global challenge and one that requires transparency and care in how energy companies source and process their biomass material – from ‘Field to Furnace’.

Drax is a power generation business responsible for meeting some 7 per cent of the electricity demand in the UK. Drax is actively pursuing a strategy of carbon abatement through efficiency improvements in the use of sustainable biomass as a substitute for fossil fuels and has recently commissioned the world's largest biomass co-firing facility in North England.

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Senator Liz Thompson
Leader of Opposition Business in the Senate of Barbados

Solar, wind and geothermal energy –

Success stories from the Caribbean

Small Island Developing States (SIDS) in the Caribbean are heavily dependent on fossil fuels, spending billions of dollars per annum on imported petroleum. However, governments are growing increasingly aware of the benefits of investing in home-grown renewable energy technologies (RETs), including solar, geothermal and wind power. Harnessing the energy from these renewable resources could open the door to environmentally sustainable development in the SIDS of the Caribbean and build a genuinely sustainable, green economy.

There is a view that fossil fuels and RETs are opposite sides of the energy coin. They are not. Instead they are disparate pieces of one side of the coin with the other side being development. To date, global efforts have been unable to craft the components of these respective pieces to ensure that they interlock. The choice is not between renewables or fossil fuels; it is in how best we marry the two to achieve national strategic development goals. Nowhere is the challenge more immediate than in SIDS which the UN has already identified as being on the frontline in the defence against climate change.

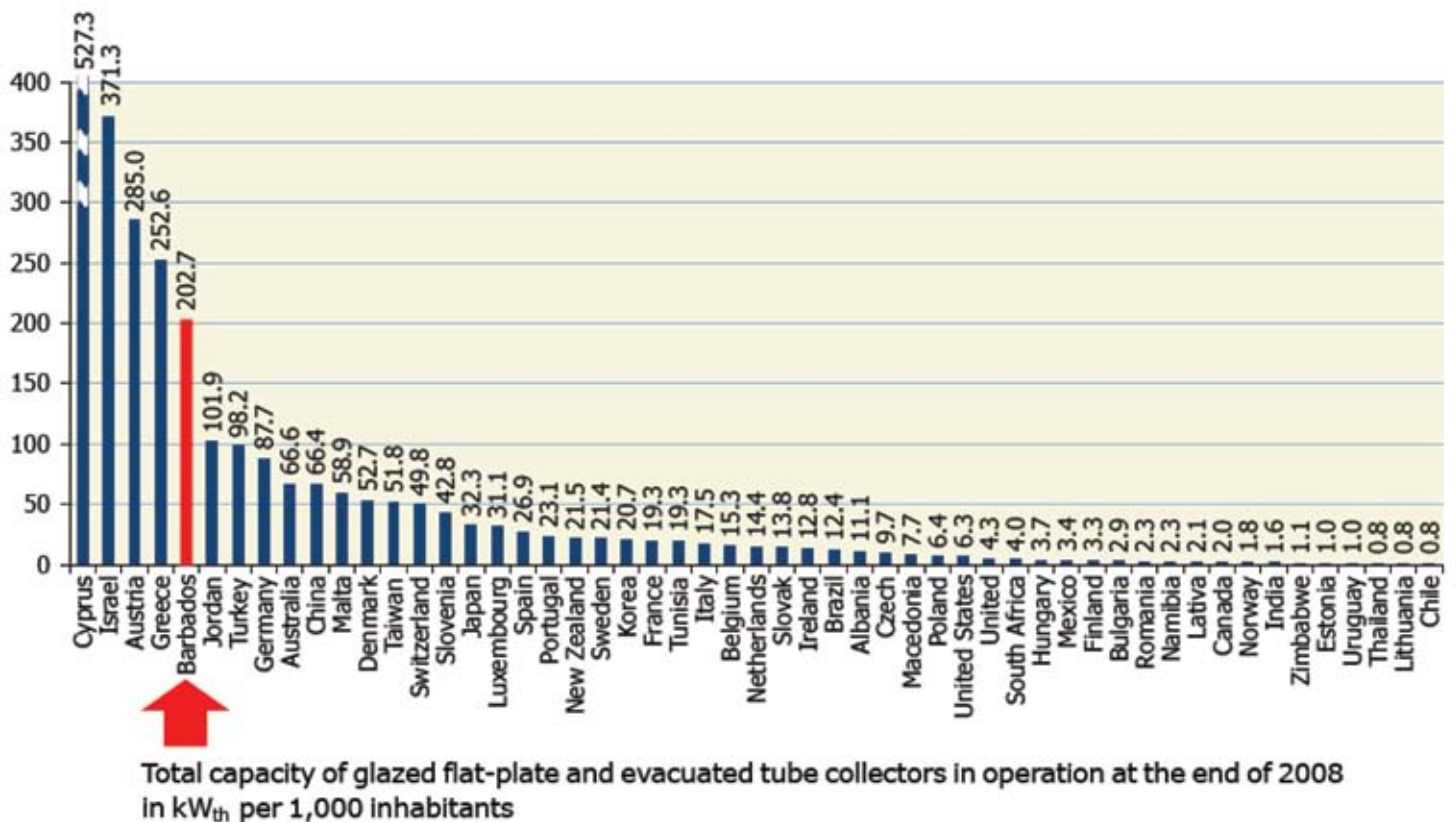
The island-states of the Caribbean face development challenges which are all fundamentally linked to the environment – access to affordable energy; land management and usage; solid waste management; planning for extreme weather events; profound water stress and water scarcity; and the mitigation of climate

change impacts. These issues are particularly acute in small island states such as the Caribbean, which derive a significant percentage of their revenues and foreign exchange earnings from tourism.

Fossil fuel dependency in the Caribbean

In the Caribbean, 95 per cent of all energy consumed comes from fossil fuels, with Venezuela, Trinidad and Tobago producing hydrocarbons for export. The islands of Barbados, Belize, and Suriname also produce a certain amount of oil which principally offsets domestic consumption. Outside of these exceptions, Caribbean countries are net importers of fossil fuels. Yet, on many islands there is tremendous potential for renewable energy – geothermal, solar and photovoltaic, hydro, wind, biofuels and biomass. These rich and inexhaustible energy sources lie largely unexplored and unexploited.

In recent years, Barbados, Grenada, Guyana, Jamaica, St Lucia and St Vincent have all initiated offshore hydrocarbon exploration programmes. The hope is to find commercially viable quantities of oil which will enable national energy independence and earn much-needed foreign exchange from export. Despite the vigour with which the offshore hydrocarbon potential is being pursued, these same islands have expressed a willingness to consider RETs where appropriate, dependent upon national circumstances.

Figure 1: Global solar water heater use, total capacity 2008 per 1,000 inhabitants (kW_{th}/1,000 inh).

The billion-dollar crude oil bill

The Caribbean's total fuel import bill was US\$6.5 billion in 2004. Three years later, at the end of 2007, fuel imports climbed to US\$12 billion. While official figures are not yet available for regional fuel expenditure in 2008, the doubling of energy prices to an historic high of US\$147 per barrel in the first half of that year would have had a corollary impact on expenditure.

In the Caribbean, only Barbados, Haiti and Trinidad and Tobago are not signatories to the PetroCaribe Agreement. Drawn up by Venezuela and launched in 2005, the agreement was to supply fuel under deferred payment terms and establish an energy management structure for the Americas. Latin American signatory countries include loan financier Venezuela, along with Guatemala, Honduras and Nicaragua. The Caribbean Signatory Countries are; Antigua and Barbuda, Bahamas, Belize, Cuba, Dominica, Dominican Republic, Grenada, Guyana, Haiti, Jamaica, St Kitts Nevis, St Lucia, St Vincent and the Grenadines, and Suriname. By December 2007, just two and a half years after the signing in 2005, signatory countries had amassed a total debt of US\$1.17 billion. In supplying these figures, eminent Caribbean economist, Norman Girvan, projected that the debt owed by Caribbean signatory countries to Venezuela under PetroCaribe would reach US\$4.5 billion by 2010. This was the estimated debt prior to the 2008 super-spike in oil prices.

Renewable Energy Technology – making the transition

According to the World Energy Outlook 2009, “governments hold the key to changing the mix of energy investment. The policy and regulatory frameworks established at national and international levels will determine whether investment and consumption decisions are steered towards low-carbon options.” Starting in 2007, seven Caribbean countries developed and published National Energy Policies (NEPs), namely Anguilla, Barbados, Bermuda, Dominica, Grenada, Jamaica, St Lucia and St Vincent. Significantly, Dominica subtitled its policy ‘A Platform for Development’ while Grenada named theirs ‘A Low Carbon Development Strategy’.

Some of the policies were entirely home-grown, some followed regional collaborations with the Caribbean Community (CARICOM) Secretariat and others grew out of efforts with regional development partners including the Inter-American Development Bank (IDB), World Bank, the European Union, the German Society for Technical Cooperation (GTZ) and the Caribbean Sustainable Energy Programme under the Organization of American States (OAS). These policies vary in strength and approach but they all promote a transition to RETs such as is appropriate for countries' individual socioeconomic circumstances and resource availability. The policies advocate an energy mix of RETs to fossil fuels in ratios varying between 15 and 30 per cent by 2020/2030.

Policy and Governance

Other current programmes and initiatives supporting RETs include:

Caribbean Renewable Energy Development Programme (CREDP) which is an initiative of the Energy Ministers of the Caribbean Community, aimed at reducing barriers to the increased use of renewable energy thus reducing the dependency on fossil fuels.

Caribbean Information Platform of Renewable Energy (CIPORE) which was established to provide an online presence for regional energy Ministries in order to disseminate and share information on renewable energy.

Caribbean Energy Information System (CEIS). CARICOM governments adopted a Regional Energy Action Plan out of which CEIS was born with a mandate to coordinate and augment existing collections of energy information.

Individual island initiatives

Barbados

Barbados is a world leader in Solar Water Heating (SWH) technology and market penetration. With a population of just under 280,000 people and 85,000 households, approximately 50,000 Solar Water Heaters are in use on the island thus reducing oil imports by 185,000 barrels per year. The island's oldest and largest SWH company, Solar Dynamics, has been in operation since 1974 when the industry was first developed. The Central Bank of Barbados calculates that between 1974 and 2009, Barbados saved almost US\$410 million in reduced fossil fuel imports.

“The policy imperative of the Government of Nevis is to become the first island in the Caribbean to generate electricity entirely from renewables.”

The successful Barbados industry uses proprietary technology, creates jobs, earns foreign exchange and is a model of best practice. Barbadian manufacturers export to other islands and 60 per cent of the solar water heaters used in the Caribbean are either built in Barbados or use Barbadian technology disseminated via concessions. In the 1970s, the government encouraged the growth of this fledgling technology by cutting import duty on all inputs for solar water heater manufacturers so as to enhance their competitiveness. At the same time, purchasers were given a full tax rebate off the purchase price of a solar water heater.

Efforts to use wind power are now underway. In addition, the 2007 national policy for Independent Power Producers (IPPs) aims to boost the level of renewable energy feeding into the national grid. Consideration is also being given to the low-ethanol fuel blend, E10.

A Barbados solar water heater system – manufacturer, Solar Dynamics.



Belize

Belize is using some degree of solar, wind, hydropower and also bagasse, a biomass derived from sugarcane and sorghum stalks. The hydropower and bagasse are fed into the national grid. Under the Sustainable Energy Partnership of the Americas (SEPA), a 2009 feasibility study was conducted on the potential of the ethanol market.

Dutch Caribbean

The Dutch Caribbean islands of Aruba, Bonaire, Curacao and Suriname already use wind power to generate electricity. Bonaire aims to be fully powered by renewables by 2015.

Dominica, Grenada and Nevis

Dominica, Grenada and Nevis have decided on geothermal energy with Nevis the most advanced of the three. The Government of Nevis signed a contract in partnership with a private energy company to execute all the necessary preparatory work. The Nevis Geothermal Resources and Development Ordinance was passed in 2008 and will be key in regulating the development of the island's geothermal energy infrastructure. The policy imperative of the Government of Nevis is to become the first island in the Caribbean to generate electricity entirely from renewables.

In addition to its geothermal potential, Nevis installed and commissioned eight wind turbines which began feeding energy into the grid in July 2010. There are also plans for hydropower generation.

Guyana

With its rich natural resources, abundant water and a land mass of 215,000km², the potential for renewable energy in Guyana is immense. The potential for hydroelectricity is particularly attractive and was identified in the 2001-2010 National Development Strategy as a critical tool for meeting the country's long-term power needs. In 2007 the total installed capacity in Guyana stood at 226 megawatts (MW) while hydroelectric potential was estimated at 7,000MW; over 30 times the required amount. In 2006, the Guyana Sugar Corporation

(GUYSUCO) increased capacity in the national grid by 15MW by implementing a co-generation project using bagasse from sugar cane. Biomass is also part of the national strategy for power generation.

Jamaica

The contribution that the Petroleum Corporation of Jamaica (PCJ) makes to the country's national renewable energy initiative is noteworthy. It established and operates the Wigton Wind Farm which feeds energy into the national grid. The PCJ also contributes biomass to the national renewable energy mix. In 2006, the PCJ established the Centre for Excellence in Renewable Energy which is now experimenting with biodiesel feedstock. In 2008, E10, an ethanol fuel blend was introduced into the national fuel mix.

CARILEC

The Caribbean Electric Utility Service Corporation (CARILEC) is the umbrella organisation for all stakeholders operating in the region's electricity industry. It has signalled its general willingness to work with Caribbean governments to support RETs, provided its members are not prejudiced.

The green economy

Renewable resources are neither finite nor scarce, offering countries the prospect of exponential and sustainable growth. Caribbean islands are perfect candidates for the transition towards the low carbon development which characterises the green economy.

Barbados is the first country of the Caribbean to develop a Green Economy Policy. The 2007 Barbados policy targets and harmonises sustainable approaches to social, environmental and economic activity. Barbados' approach parallels the concept of a green economy as advanced by the United Nation's Green Economy Initiative, given on their website, as including "green energy generation based on renewable energy to substitute for fossil fuels and energy conservation for efficient energy use. The green economy is considered being able to both create green jobs, ensure real, sustainable economic growth, and prevent environmental pollution, global warming, resource depletion, and environmental degradation." Harrison Cave, Barbados' largest natural attraction has been re-engineered as an entirely green operation, demonstrating the government's commitment to sustainability.

What's next for a greener Caribbean?

Having developed clear policy initiatives for sustainable energy development based on RETs, the next step is securing a long-term, political commitment to renewables, irrespective of the cost of petroleum products. The traditional pattern has been that when international oil prices are high, there is great enthusiasm around renewables but that energy levels wane once fuel prices fall.

The development of appropriate, indigenous RETs is well within regional capability. The Barbados success

story with solar water heaters is an indication of what the Caribbean region and SIDS worldwide can accomplish in the areas of RETs, innovation, capacity building and the development of a green economy. The small size of the islands is an advantage in the implementation of pilot projects and the establishment of RET initiatives which are easier to scale and monitor. There has been some discussion about piloting various technologies in a number of islands, from geothermal in Nevis and Dominica to Ocean Thermal Energy Conversion (OTEC) in the Bahamas. The building of capacity to handle the new technologies and the training of nationals in maintaining and operating these technologies will be vital to their success.

The major challenge facing the Caribbean however is, as always, funding as RETs are high-cost to establish. Given the state of the global economy which has had a considerable adverse impact on the region, finding the resources to set up such projects will pose considerable difficulty. A combination of grant and loan funding is necessary. I would wish to suggest that the region's development partners start a Caribbean Regional Development Fund for RETs to which the islands themselves should also have responsibility for contributing. Some degree of optimism is pinned on the Clean Development Mechanism (CDM). Without adequate financing however, RETs in the Caribbean will not move past the level of rhetoric, policy statements and embryonic steps.

Given the urgency to adapt to and mitigate climate change impacts, the requirement to plan our development in a sustainable fashion and the need to reduce our dependency on fossil fuels, in the context of what the Commonwealth and World Bank describe as "the peculiar vulnerabilities" of the SIDS, there is some immediacy required in our response, approach and strategies. The Caribbean must wean itself off fossil fuels, transition to RETs or face the consequences. Thankfully, that effort now seems to be genuinely underway.

Senator Liz Thompson of Barbados is an opposition Senator in the Barbados Parliament. First elected to Parliament in 1994, she was Minister of Environment until 2008. She also jointly held the Energy Portfolio from 2006. Winner of the 2008 UNEP "Champion of the Earth" award, she has led effective national policy interventions in sustainable development, the green economy, offshore petroleum and energy, working towards an energy target of 30 per cent from renewables by 2020. She has been responsible for critical national projects relating to solid waste management, sewerage and biodiversity. Senator Thompson negotiated at Kyoto and was one of a small group of ministers who crafted the 'Bali Roadmap'.

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Minas Gerais Commitment to Climate Change



State Government

Minas Gerais, one of the 27 states of Brazil, is located on the southeast region, being the fourth state in territorial extension. In terms of population it is the second due to its more than 20 million inhabitants. Its Gross Domestic Product (GDP), estimated in R\$ 252 billion (in Reais) in 2008, is the third in the country. The State stands out in the Brazilian economy because of its industrial production based on mineral extraction, steel mill, iron alloys, aluminum, pulp and paper and automobile industry. Minas also stands out in livestock farming, having the second largest cattle herd in Brazil. The State's industrial profile reflects the exploitation of its several natural and mineral resources, mainly iron ore, water and forest.

ENERGY USE

With an industrial sector where energy intensive industries predominate, Minas, differently from other economies, has developed an energy matrix focused on renewable resources which share 54% of an annual total of around 35 millions oil equivalent ton (tOE). Among these resources firewood, charcoal, hydroelectricity, ethanol and sugar cane bagasse stand out.

The great firewood share is owed to the steel mill industry which uses the charcoal in the production of pig iron and steel, a unique experience on the global scenario, which was developed in Minas Gerais on the first half of the twentieth century.

Minas Gerais territory shelters springs of important Brazilian rivers as well as several watersheds. Advantage is taken of its hydropower potential through the construction of power plants that supply 96% of the State's need for electric energy. From a total of 12 thousands megawatts installed, 90% have hydraulic origin.

Since the seventies Minas Gerais has invested in the scientific and technological development of planted forests. Currently, the State counts on approximately 1.8 million hectares of eucalyptus forests that supply companies which produce pig iron, steel, iron alloys, pulp and paper.

ACTIONS FOR MITIGATION OF CLIMATE CHANGE

Although Minas has an energy matrix considered clean, the State Government, through the State Secretary for

Environment and Sustainable Development (Semad) and State Foundation for the Environment (Feam), has implemented several actions and programs whose objective is to voluntarily contribute to the global effort to reduce the greenhouse gas emissions (GHG's). The definition of the State Policy on Climate Change and its respective Action Plan will be achieved through a careful and judicious analysis of economic, social environmental and political factors which will contribute to the reconcile of economic growth and sustainable development.

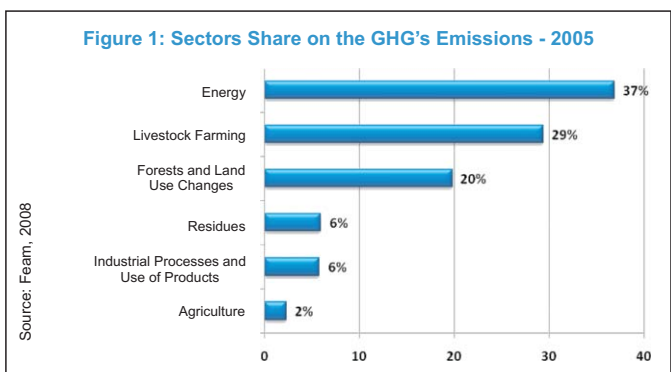
The Inventory on Greenhouse Gas Emissions, an underlying document for the preparation of the State Policy, has not only allowed to identify the State's profile relative to the emissions caused by its socioeconomic activities, but also to define priorities to the actions to be implemented.

As a consequence of the intensive use of energy in its industrial sector, most of the emissions are caused by the energy sector, followed by livestock farming, forests and land use changes, as shown on Figure 1. In the energy sector, industry and transportation are the main emitters (Figure 2). In the industrial sector what stands out is the share of use of energy on steel mill industry which represents 72% of emissions. In the transportation sector, the road modal was responsible for 96% of emissions, with diesel emissions predominating.

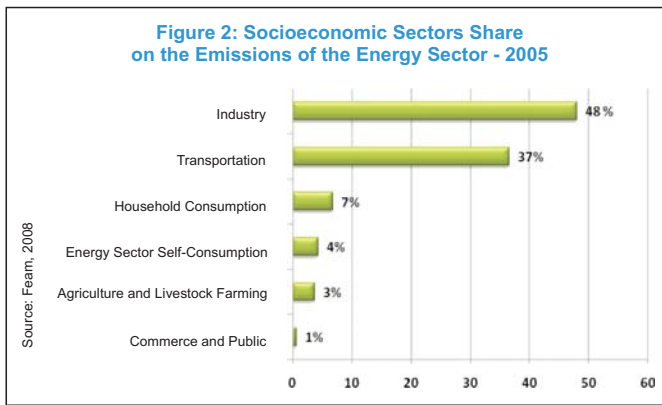
Availability of calculation tools, training of staff of companies from different sectors and economic activities, in order to identify and quantify their emissions, as well as adopt management measures to reduce them are priority actions towards the management of GHG's emissions by the productive sector.

The Voluntary Public Register Program of Annual GHG's Emissions made it possible for companies and ventures in

Figure 1: Sectors Share on the GHG's Emissions - 2005



Source: Feam, 2008



Minas Gerais to use an online platform which allows the quantification of information related to their emissions and the calculation of indicators – carbon intensity, energy intensity, including the concession of incentives to the access and benefits on environmental permits, aiming at the improvement of those indicators.

The Program Residue is Energy has promoted incentive actions concerning the proper disposal of urban solid waste to produce electric power, increasing the power generation from renewable sources and, therefore, reducing emissions. The objective of the Solid Waste Program is not only to eradicate urban dumps but also to utilize the biogas produced in landfills, decreasing methane emissions.

On the Forest Field, programs developed by the State Forest Institute (IEF), such as Environment Fostering and Green Grant, promote preservation and recovery of the native vegetation. The first is directed to permanent preservation areas, to the recovery of degraded areas and afforestation of urban and rural areas, as well as of areas that surround highways. It is done by giving inputs and technical assistance to the planting of an area with its natural and original vegetation. The second program aims at supporting the conservation of the native vegetation cover by granting land owners and squatters who already preserve or commit to recover the vegetation on their land.

STATE POLICY AND PLAN ON CLIMATE CHANGE

The State Policy on Climate Change, about to be concluded, aims to develop a low economy and is based on six strategic components: mitigation, adaptation, quantification, verifying and monitoring, technical training and transference of technology, education and awareness of society as well as funding sources.

The State Plan on Climate Change shall be built from Sector Plans and will take into account contributions from all of the sectors involved and will define voluntary goals on the reduction of carbon intensity, as well as the respective actions to this achievement by each sector. The Plan must contemplate definition and dissemination of actions according to the following prior lines: energy efficiency, decarbonization of energy sources with emphasis on the production and consumption of renewable energies, planning and adjustment of the transportation sector seeking a greater use of the urban public transportation; change in the behavior of productive sector as well as consumers; preservation and expansion of carbon sinks, mainly through the control of deforestation; recovery of degraded areas, reforestation and afforestation;

reduction on the emissions of industrial and urban waste; technological modernization of productive processes; development of scientific-technologic research lines and diffusion of technologies, processes and practices related to climate change.

Actions aimed at mitigation will emphasize the reduction of carbon intensity, promoting energy efficiency and economic growth with low emissions. The State seeks to evaluate the possible impacts of climate change over its economy once it is aware that its economy is highly dependent on agriculture, as well as on renewable sources which are vulnerable to effects of climate change. Therefore, the close connection between mitigation and adaptation is made fundamental due to the fact that both are critical to the socioeconomic development of developing countries and regions.

The evaluation of environmental impacts over the State's economy is about to be concluded. It shall guide decision-makers and help them not only to define priorities but also to determine mechanisms to implement and monitor adaptation actions. The economic, social and environmental impacts will be indentified, taking into account micro regions and socioeconomic sectors of the State and based on that information adaptation actions will be prioritized towards the definition of a plan that aims to combat the adverse effects of climate change.

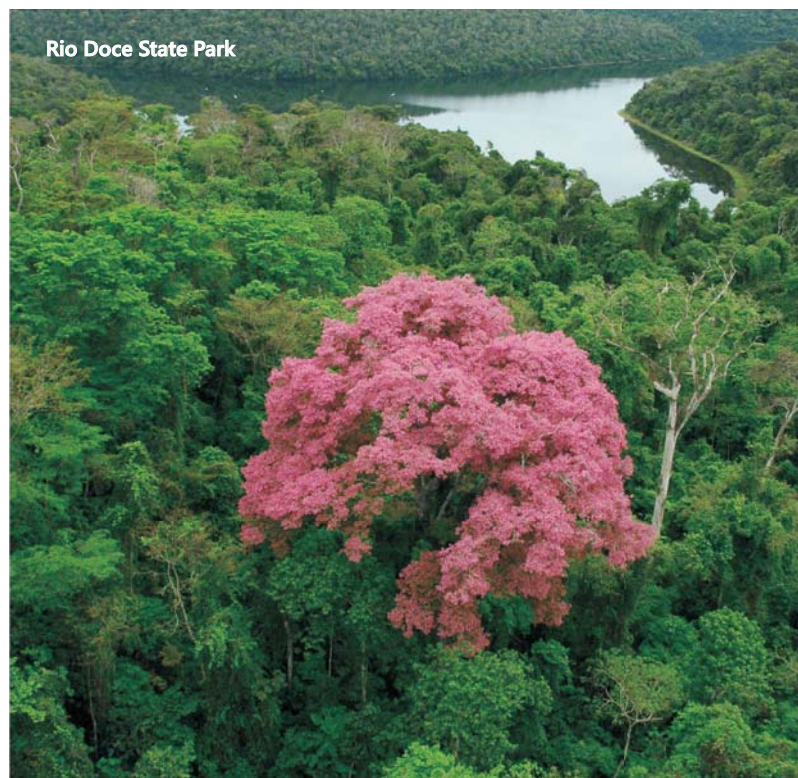
The technological and business knowledge of production and use of renewable energy, base of Minas Gerais' low carbon economy, allied to a policy based on its maintenance and expansion, may contribute to the global effort to reduce greenhouse gas effect emissions, which is necessary and essential in order to keep climate change within the acceptable limits.

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*Translation and layout: Inês Sadala - Photographs: Evandro Rodney





The EPM Group:

Leading Colombia on climate change



The EPM Group, (Empresas Públicas de Medellín) comprises of 12 state-owned companies, with the participation of a further eight, based in the municipality of Medellín in Colombia. The Group applies the highest international quality and environment standards to the key services it provides across Colombia, including: electricity, natural gas distribution, water and sanitation, and telecommunications. The EPM group is the largest company in Colombia after oil company Ecopetrol.

Among Colombian companies, the EPM Group is a pioneer in climate change mitigation. It is a clean energy leader, generating 80 per cent of its energy from hydropower. The Group adheres to strict environmental guidelines and procedures in its operations.

“The Group applies the highest international quality and environment standards to the key services it provides across Colombia.”

EPM members have demonstrated a remarkable commitment to reduce greenhouse gas (GHG) emissions across their businesses:

Mitigation: EPM pioneered the development of clean energy projects in Colombia using the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (UNFCCC). Among them is Jepírachi, Colombia's first wind power project (19.5 MW), in very northern province of La Guajira. This pilot project began generating electricity in 2004 and also supports a social

programme for the local indigenous Wayúu communities. Other renewable energy projects include, La Vuelta (the Spin) and La Herradura, (the Horseshoe), two hydroelectric power plants in the Antioquia province.

Adaptation: EPM has a wide-ranging project portfolio to be registered either in the formal greenhouse gas emissions markets or voluntary market, or to obtain other types of clean emissions certificates. These projects include: the Bello Water Treatment Plant, the fuel substitution programme with natural gas (for public transportation and industrial use), a Reducing Emissions from Deforestation and forest Degradation (REDD) project, and the modernisation of the company's headquarters. The EPM Group is currently defining a baseline for its own GHG emissions in all the companies of the Group, using the GHG Protocol (boundaries 1 and 2), to assess its carbon footprint.

For EPM members, it is vital to analyse the long-term impacts of climate change on water availability in the basins where their energy and water operations are located. As a result, EPM is currently working with the Hydrology, Meteorology and Environmental Studies Institute of Colombia (IDEAM), to study the climate change effects on two pilot basins. Also, in association with The Nature Conservancy, it is leading an initiative to bring together public and private investors to structure a Water Fund (a conservation trust fund) to preserve the Rio grande and la Fe basins.

For more information, visit: www.epm.com.co
www.somosgrupoepm.com

The EPM Sustainability Report:
http://www.epm.com.co/epm/institucional/general/Balances/2010/Informe_Sostenibilidad_2010.pdf

Nightschool of Barefoot College in Tilonia/Rajasthan using solar powered batteries. Woman cleaning solar panels.



© Marcus Franken/Greenpeace



Lalita Ramdas
Founding Member of Greenpeace India

The threat of climate change is demanding nothing short of a revolution in our energy systems. With India as an example, Lalita Ramdas, current chair of the Greenpeace International Board, looks at the process of transformation towards a renewable energy system in the country and argues that nuclear energy – the Indian government’s choice for future energy provision – is the wrong option. She outlines the roadblocks ahead in achieving a clean, sustainable energy future for India and asks what the people can do to further an Energy [R]evolution.

The world has arrived at a dangerous place – climate change caused by the relentless build-up of greenhouse gases in the Earth’s atmosphere could lead to disruption in our ecosystems with devastating consequences. If this planet and those who inhabit it are to be saved, we need an energy evolution, but one that happens rapidly. We need what we at Greenpeace are calling an Energy [R]evolution – a radical shift in the way the world produces, distributes, and ultimately consumes, energy.

Dramatic reductions in greenhouse gas emissions have to be made – especially by the developed nations but also in several emerging economies like China, Brazil and India.

Whether in South Africa, from where I have just returned, or in India, where I live, for example, the challenge is clear. While there is a buzz around climate change and its impact on our environment and lives, when it comes to discussing the tough decisions, the tendency is

Mother Earth, can you kick- start an Energy [R]evolution?

The quest for a global renewable energy future

to use the TINA principle: There Is No Alternative.

But there is! An Energy [R]evolution is possible and based on the following principles we can show this as a ‘win win’ scenario – a win for people and for the planet:

- Implement renewable solutions, where possible through decentralised systems;
- Respect the natural limits of the environment;
- Phase out dirty, unsustainable energy sources;
- Create greater equity in the use of resources;
- Decouple economic growth from the consumption of fossil fuels.

The Energy [R]evolution scenario – developed by Greenpeace in conjunction with more than 30 scientists and engineers worldwide – envisions a transition from dirty, deadly energy, such as coal and nuclear, towards renewable energy. It will empower local communities to produce, monitor and profit from their own energy use and help supply energy to the 2 billion people around the world who have little or no access to reliable energy services. In the process it will radically reduce greenhouse gas emissions helping to avert climate chaos.

India’s energy options in 2010

Let us take a look at India and what can be achieved. While India is experiencing an impressive growth rate, challenging inequalities continue to deprive very large numbers of access to basic amenities, especially energy

services. A booming economy has fuelled a seemingly insatiable appetite for energy and infrastructure development, with major investments being made in power generation and distribution. By 2031, India's energy demand could increase as much as seven-fold based on an annual growth rate of eight to 10 per cent.

To meet the demand, India has adopted an aggressive nuclear policy with nuclear power being seen as critical in meeting energy needs and providing energy security while tackling greenhouse gas emissions. In 2009, the signing of the 123 Agreement as part of the contentious Indo-US nuclear deal created wider awareness and debate on the implications of nuclear power for India. The intrinsic pitfalls of nuclear had almost no chance against much shriller voices arguing that the nuclear option would enhance India's national pride, and ensure energy self-sufficiency. National pride in India, is a force to be reckoned with.

India has pledged to reduce its carbon intensity by 20-25 per cent in the next 10 years and aims to become a leading solar nation, in terms both of the scale of its application and of focused research. Yet there continues to be a strong perception that the country's leaders in both political and corporate spheres have staked their bets on continuing down a 'growth-at-all-costs' trajectory.

Why nuclear isn't the solution for India

India plans to have 20,000 MW of nuclear energy by 2020 and 63,000 MW by 2032 or the equivalent of some 31 new nuclear reactors. Many are planned in areas with a high population density.

India rushes headlong into nuclear with no acknowledgement of its very poor track record in safety. Recent events have demonstrated that India is poorly equipped to deal with the safety implications of its existing nuclear industry and further expansion would only exacerbate the problem.

Two-light solar system – both for security and safety – installed on the hut of migrant workers in the state of North Karnataka, India.



There are glaring inadequacies in the existing policy and regulatory framework. The Atomic Energy Act of 1962 has not kept pace with recent political developments in the field of civilian nuclear technology nor is there a coherent distinction between civilian and military nuclear affairs.

The bottom line, as summed up by a researcher on nuclear waste for the Heinrich Boll Foundation, is that "the 123 agreement provided India with a de facto recognition as a nuclear weapons state. There has never been a 'peaceful' nuclear programme anywhere in the world – and if nuclear power is not used to make weapons, at the very least these cause immeasurable ecological damage."

The regulatory regime is both redundant and lacks transparency. It is impossible to prise information out of what has been referred to by a former insider as "an opaque black box".

Given the track record of overruns in both cost and time in the construction of nuclear power plants – both in India and abroad – it is extremely doubtful that the nuclear option will meet the power and energy requirements of the next decade. Meanwhile, existing plants will at best be able to provide a total of 3.1 per cent of the country's electricity needs.

Indian energy policy continues to view renewable energy as a token complement to nuclear and fossil fuels, rather than a viable alternative.

Renewable energy – a force to be reckoned with

Many energy experts and business entrepreneurs already recognise India's renewable energy potential. They are able to visualise what a renewable energy intensive pathway would look like for a country like India; a pathway that takes into account the fact that 70 per cent of the population still live in rural areas, many of which continue to struggle for basic survival in adverse, energy-deprived conditions. Summed up below are some suggestions on concrete, practical steps to be taken which see the country's poor as partners and allies in making an Energy [R]evolution a reality:

1. Explore linkages between renewable, decentralised energy and poverty alleviation through income generation.
2. Motivate the large number of state-level technical institutes to design and implement a range of simple interventions – such as solar lighting to replace kerosene lamps – thus synergising technology, finance and marketing for small entrepreneurs.
3. Involve local communities and existing local technology institutes, especially in rural areas, in developing workable solutions using futuristic ideas and innovative financing plans. Devise financing plans for energy efficient, safer alternatives to the 'three-stone' gas cooking stove of the poor, for example, or a solar light bulb which a poor woman or the small-scale vendor can pay for on a daily rather than a monthly basis.
4. Urgently prioritise appropriate technology together with details of the supply chain and financing, which would make solar, biogas and small hydro affordable to the poor today; not tomorrow.

5. Make the poor central to energy policies as participants rather than passive recipients.
6. Incentivise financial institutions to shift their resources into the energy sources of the future. Legislation could bring rural and nationalised banks to earmark a certain percentage of investment as priority sector financing for solar energy.
7. All changes need to be strengthened and prioritised by effective and proactive policy frameworks which would include phasing out all subsidies for fossil fuels and nuclear energy.
8. Measures to internalise the social and environmental cost of energy production must come into effect rapidly. Such measures include cap-and-trade mechanisms, the mandating of strictest efficiency standards for all energy consuming appliances, buildings and vehicles, establishment of legally binding targets for renewable energy and the radical reform of electricity markets by priority access to grids for renewable power generators. The latter would help ensure stable returns for investors in renewable energy, by feed-in tariffs for example.
9. Finally, possibly most importantly, we must increase the research and development budget for renewable energy and energy efficiency.

There are many good reasons why India should make the transition to renewable energy, phasing out both coal and nuclear. But, as of now, there is no policy road map which visualises a complete switch to clean, renewable energy.

Obstacles to a clean energy future

There are a number of road blocks to achieving a clean, sustainable future instead of one based on dirty, and deadly, energy. The current business environment is one: policies emanate from the outdated, Bretton Woods era of financial institutions and the well-known nexus between corporate and political leadership. The G8, nuclear states, and even the world's emerging economies are each busy balancing the demands of a loud and influential domestic middle class while proffering minimum sops to the poor and powerless.

Corporations are another road block. According to e-magazine, *Climate Progress*, the oil, gas, and coal industries spent US\$543 million on lobbying in 2009 and the first half of 2010 to kill the US Climate Bill and push offshore drilling.

Power to the people – what can we do?

If India and the rest of the world are to resist the temptations to chase after short-term profits and take calculated risks for long-term gains instead, extraordinary levels of mobilisation will be necessary on all levels. At the one end, political and business leaders who are still open to dialogue will have to be engaged. At the other, those who are most affected will have to be considered. Can these disparate and diverse forces come together to speak truth to power (or power to truth)? Their very lives and existence depend on it.

On October 2 this year on the anniversary of Mahatma Gandhi's birth, one of India's leading newspapers took

Greenpeace donates a solar power system to a coastal village in Aceh, Indonesia, one of the worst hit areas by the tsunami in December 2004.



© Greenpeace/Hoti Sumanjatak

out a half-page advertisement on behalf of the Ministry of Power pledging to bring “light into the life of the last man [no mention of women] in the remotest corner of India.” They quoted the great man as saying: “India cannot prosper if rural India lags behind and I think rural electrification is the first step towards this.”

Gandhi, a man who was able to confront the might of the British Empire with non-violent direct action and civil disobedience by picking up a fistful of salt in defiance of the oppressive and unjust laws of the colonisers, would be the first to join us in this Energy [R]evolution.

It is our challenge to find the moral courage and discipline to push for what we believe is right. If we fail now, we force ourselves to ask, as JFK did: “Will we look into the eyes of our children and confess that we had the opportunity, but lacked the courage? That we had the technology, but lacked the vision...”

Lalita Ramdas is an educator and activist. Education for marginalised and minority communities, human rights and peace have always been central in her work and writing. She is a Founding Member of the Board of Greenpeace India and currently Chair of the Greenpeace International Board.

Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace. It comprises 28 independent national/regional offices in over 40 countries across Europe, the Americas, Africa, Asia and the Pacific, as well as a coordinating body, Greenpeace International.

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Implementing climate protection measures in the State of Bahia, Brazil

Bahia, one of the 26 states of the Federal Republic of Brazil, is located in the country's northeastern region. With a territory of 567,692 km², it is larger than France or Spain. Its coastline stretches over 930km and features dunes, lowlands and mangroves. Brazil also features uplands to the southeast, semiarid vegetation, over a thousand kilometres of waterways and part of the São Francisco valley basin. Tropical weather prevails, with temperatures ranging between 19-26°C.

The state has 14 million inhabitants in 417 municipalities, with nearly four million inhabitants in its capital, Salvador.

Mitigation actions in Bahia

The state government, represented by its Special Environment Agency (Sema), has been implementing projects to contribute towards the reduction of greenhouse gas (GHG) emissions.

Sema has monitored the international negotiations for a climate agreement as a member of the Brazilian delegation since the COP 13 in 2007. As a member of the Work Group in the Brazilian Forum on Climate Change, Sema has helped with the preparation of the National Policy and Plan for climate change. Sema has also played an active role in the REDD and Climate Change taskforce in the Brazilian Legal Amazon States.

Its activities at state level include the preparation of the State of Bahia's Climate Change Policy under the directive of the state government's Budget Guidelines Law of 2009, and the preparation of the state's first GHG emissions inventory for monitoring the use of solvents in the energy and industry sectors. Sema is currently preparing the State Plan for Climate Change to start proposing further climate-change related adaptation and mitigation measures.

Forest protection is a major area of work for Sema. Forest projects developed by Sema contribute to the recovery and preservation of native vegetation and reduce CO₂ emissions. Projects include Pronaf Florestal, in which the government provides technical assistance, and facilitates environmental adaptation through the donation of tree saplings to help rehabilitate degraded reserve areas. Another project – Riparian Forests

Recovery – aims to promote conservation and improve the health of riparian ecosystems, the ecosystems found along the margins and banks of rivers. It is protecting and replanting riparian forests in critical areas of the Bahia's hydrographic basins. Floresta Bahia Global is a further project developed by Sema and aims to aid the recovery of vegetation coverage in key biomes, neutralise the carbon emissions from human activity, and develop carbon capture technologies.

A GHG emissions inventory

The state government of Bahia, represented by Sema, prepared the first State Greenhouse Gas Emissions Inventory, an initiative addressed in the state's Climate Change Policy. Co-ordinated by the Bahia Forum on Global Climate Change and Biodiversity, this inventory is a major step in implementing Bahia's State Plan for Climate Change.

The energy sector

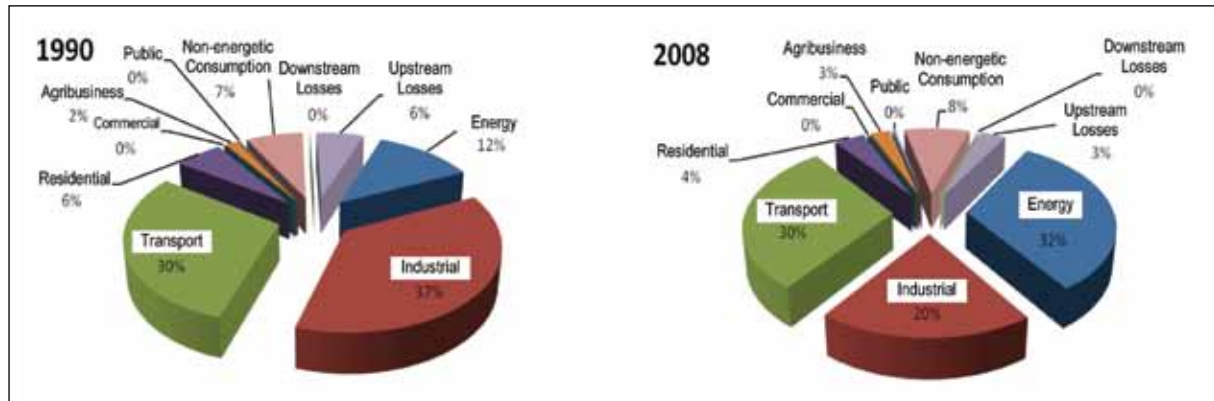
Estimations of the GHG emissions originating from fuel burning in Bahia's energy sector are based on data disclosed in the Bahia Energy Balance Sheets (BEEBA), published in 2008 and 2009.

A 'bottom up' methodology was applied for estimating emissions from fossil sources. It enables the calculation of the energy sector's GHG emissions originating from fossil fuels according to the fuel type and activity sector.

The sector's emissions and removals relate to the following GHGs: carbon dioxide, methane and nitrous oxide. However, the inventory also includes other gases commonly emitted, such as carbon monoxide, nitrogen oxides and other non-methane volatile organic compounds. Although these are not considered direct GHGs, they impact on the chemical reactions in the atmosphere and therefore should also be measured and monitored.

The CO₂ emissions from the burning of renewable biomass for energetic purposes were not included in the state's total emissions as the CO₂ emitted was absorbed during the plants growth cycle.

Figure 1: GHG emissions by activity sector in 1990 and 2008.



The energy sector inventory was developed under the disaggregation level adopted by the state's Energy Balance Sheet of 2009. It covers the emissions from various subsectors and adheres to the structure suggested by the Intergovernmental Panel on Climate Change (IPCC).

In 2008, Bahia's energy sector generated GHG emissions totalling 28,555 GgCO₂-eq (gigagrams of CO₂ equivalent), making it the state's biggest carbon emitter, responsible for a third of total emissions. The transport and industry sectors were the next biggest polluters, responsible for 30 per cent and 20 per cent respectively. GHG emissions in Bahia have increased by over 80 per cent from 1990 levels.

As shown in Figure 1, the share of total GHG emissions generated by the energy sector has increased significantly between 1990 and 2008. In 1990, the industry sector was the highest emitter, responsible for 37 per cent of total emissions in the state, while the energy sector contributed only 12 per cent.

The transport sector's emissions increased by 80 per cent over the same time period, largely due to the road and air sub-sectors. Waterways, meanwhile, have seen a sizeable drop in emissions.

The industrial processes and product uses sector

This sector measures the emissions from production processes that are not included in the energy sector. These emissions originate from various industrial activities.

Between 1998 and 2008, CO₂ emissions in the industrial sector had increased by 9.8 per cent. In 2008, the non-metallic minerals subsector was the highest emitter of all those in the industrial sector, responsible for over 47 per cent of emissions, followed by metallic minerals, (36.1 per cent), and the chemical industry (13.5 per cent).

State of Bahia's Climate Change Policy

The bill to institute the state of Bahia's Climate Change Policy is currently awaiting the House of Representative's appraisal and voting. It aims to align social and economic development with climate system protection measures by: mitigating the adverse impacts of climate change; reducing the growth rate of GHG emissions while developing carbon capture and storage technologies; and defining and implementing climate adaptation measures

in all Identity Territories, especially those most vulnerable to the predicted adverse effects. These goals seek to foster sustainable growth, eradicate poverty and reduce the state's social inequalities.

The proposed policy was jointly prepared by several segments of the state and civil society during discussions facilitated by the Bahia Forum on Global Climate Change and Biodiversity. It expresses the State of Bahia's commitment to the global climate change challenge and its attempt to balance economic development with the vital climate change protection needed for present and the future generations.

Bahia's bill was submitted after the national Brazilian Climate Change Policy was instituted in December last year. It means Bahia's bill not only reflects the environmental scenario of the State of Bahia, but is also aligned with the principals guiding the country's national policy and the concerns of the international political agenda. They share the objective to implement key climate system protection measures while recognising the importance of continued economic growth.

In addition to describing the main goals, directives and instruments of the State Climate Change Policy, the proposal paves the way for the State Plan for Climate Change, which will set concrete actions for reducing or stabilising GHG concentrations in the state. It will therefore be an important contribution towards meeting Brazil's voluntary commitment to cut emissions by between 36.1 and 38.9 per cent by 2020, as pledged by President Luiz Inácio Lula da Silva during the COP 15 in Copenhagen last year.

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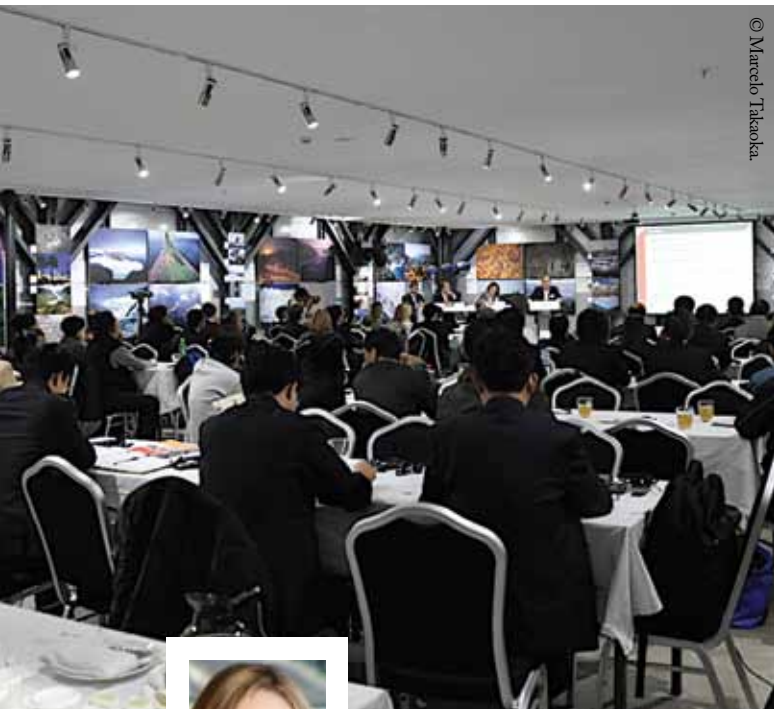
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UNEP-SBCI Symposium on Sustainable Buildings, Shanghai, 29-30 October 2010.



Maria Atkinson
Chair of the UNEP-Sustainable Buildings and
Climate Initiative (SBCI) Board

Buildings provide common ground for outcome in Cancun

The building sector can provide common ground for the Conference of the Parties as they meet in Cancun – a vital step for any global agreement on climate change, says Maria Atkinson, Chair of the UNEP-SBCI Board. Buildings are often overlooked in climate change discussions but they are responsible for almost a third of our global greenhouse gas (GHG) emissions. A common carbon metric would incentivise and accelerate the vital process of green refurbishment in existing buildings, bringing impressive, cost-effective carbon savings.

If we're seeking common ground among nations, buildings are surely a good place to start. After all, while they may differ in size and shape, they exist in developed and developing countries across the globe. Many of us spend 90 per cent of our lives in buildings such as houses, schools, hospitals, offices and factories.

The building sector is inextricably linked to economic and social development. Globally, it is one of the largest employers – some 10 per cent of the world's workforce.

On the downside, buildings are responsible for approximately 40 per cent of global energy use and up to 30 per cent of GHG emissions. The sector has also been one of those worst hit by the global financial crisis.

The good news, however, is that the building industry has the greatest potential for delivering GHG emissions cuts, at the least cost, using available and mature technologies. In fact, new research shows that the emissions reduction potential in buildings is much higher than was presented in

the buildings chapter of the *IPCC 4th Report*.

Despite these facts, the building sector continues to be overlooked in discussions by governments around the world and lacks the enabling policy frameworks that would let it deliver deep, fast, low-cost emissions reductions and a range of social and economic benefits. Key players in the global building sector have been collaborating to develop a common carbon metric for the sector to allow it to accurately measure the carbon performance of buildings in a consistent manner, and enable meaningful comparison or baseline establishment and target setting for GHG emissions reduction. It will also allow governments to measure, report and set targets for emissions reduction in the building sector and avoid the catastrophic impacts of climate change.

Now it's time for governments around the world to step up to support the sector's efforts and at the same time lock in economic development for their countries.

Common Carbon Metric

As Lord Kelvin, mathematical physicist and engineer, famously enunciated, "What can be measured can be evaluated, improved, directed – in short, managed".

But the building sector lacks the metrics needed to allow it to accurately measure the carbon performance of buildings in a consistent manner worldwide, let alone to evaluate a building's performance against others, or inform its improvement.

Addressing this problem, the UNEP-SBCI members and partners agreed to collaborate to develop

a Common Carbon Metric for the global building sector in December 2009. Ultimately, it will lead to the establishment of baselines and benchmarks to make meaningful comparisons, and set targets for verifiable GHG emissions reductions across the sector. UNEP-SBCI is working in partnership with the World Green Building Council and the Sustainable Buildings Alliance to address baselines, benchmarking, and monetization.

The scope of the Common Carbon Metric project is necessarily wide-ranging to suit the very specific needs of both policymakers and the market for a multitude of purposes.

The market, including building owners and facilities managers both public and private, sees value in a common protocol for accurately measuring, documenting and monitoring performance data, to allow for meaningful comparison and verifiable assessment of the success of technologies or strategies implemented to reduce emissions.

By aggregating individual building reports by city or region, policymakers will be able to accurately determine and monitor the important role of the built environment in reducing the emissions profile of their jurisdiction. The raw building performance data will also enable policymakers to establish building sector performance baselines or reference points.

This data can then be ‘corrected’ or ‘normalised’ to account for climate, establishing benchmarks for each

building type in different climatic locations against which the market can make building-by-building comparisons and with which it can make informed decisions on investment priorities. Policymakers can use such benchmarks for the allocation and verification of fiscal incentives, as well as for setting annual targets and longer term trajectories.

The table below summarises the key purposes and benefits of the Common Carbon Metric.

Reporting

Accurate portfolio and sector reporting is needed at a range of policymaking levels:

Country: National inventory reporting under the Kyoto Protocol and its successor; policymakers need accurate reporting to establish reference points for setting building codes and for planning; raw data on building stock and from individual buildings per type of building and climate region is needed.

Organisations: Voluntary reporting indices such as the Global Reporting Initiative, Dow Jones Sustainability Index, or the Carbon Disclosure Project (CDP); shareholders need information for investment decisions; businesses need specific reporting for asset management and capital allocation prioritisation. Asset performance against the benchmark for building type and climatic location is needed.

Purpose	Benefit
Policy Setting	
Baseline establishment	<ul style="list-style-type: none"> Buildings recognised as part of Nationally Appropriate Mitigation Actions Inventory reporting (NAMAs)
Sectoral reporting and city, state or province and country level	<ul style="list-style-type: none"> National emissions inventory for all sources and all sectors Common reporting framework for reporting to government Robust building sector information for policy makers at all levels Total emissions known for all building types
Market Information	
Benchmark setting	<ul style="list-style-type: none"> Education for design professionals
Market rating/certification – design & asset ratings	<ul style="list-style-type: none"> Overcome information symmetry Informed market decision-making on investment priorities
Market comparison	<ul style="list-style-type: none"> Informed decision making for sales of buildings, or leasing or staying in buildings
Operational impact assessment	
Disclosure at point of sale/lease	
Analytical and assessment tools	
Market Shift	
Target/cap & trajectory setting	<ul style="list-style-type: none"> Verifiable environmental outcomes for policymakers to improve allocation of fiscal incentives
Monitoring & verification procedures	<ul style="list-style-type: none"> Capital management for building owners
Financial assistance & incentives	<ul style="list-style-type: none"> Improved project methodologies for Clean Development Mechanisms and voluntary carbon markets. Return On Investment (ROI) planning for building owners
Market Transformation	
Sector specific carbon trading mechanisms	<ul style="list-style-type: none"> Drive laggards in the sector Deep mine the property sector to unlock abatement opportunities Stimulate innovation

Reporting frameworks, calculations, definitions and reporting obligations are different for the above and therefore international agreement is needed.

Baseline

The reporting of accurate raw data on building stock at the national or city level enables a ‘baseline’ of performance or reference point to be established for each building type, and for the accounting of year-on-year inventory reporting of total emissions.

For baselines, governments can estimate the energy use of their building sector supported by information gathered from utilities or municipal accounting. With this, governments can provide valuable information on national and city baselines for their total sum of building stock and also break this down to baselines per building type. Baselines allow governments to understand the performance of this sector on a large scale and set reasonable targets and supporting policies to increase performance.

Benchmark

To allow for meaningful comparison of the energy and carbon performance of specific buildings, the raw data presented by the baseline needs to be verified by measured data sampling at the building level, to produce a benchmark.

A benchmark for a specific building type and climate region enables informed decision-making about a building’s performance, whether by a building owner assessing investment priorities, a tenant assessing or comparing a tenancy, or a hotel guest choosing accommodation.

Without a benchmark against which to analyse a building’s performance, the energy consumption and

GHG emission data has little meaning or value for the industry and its customers.

The benchmark will provide an understanding of the average carbon and energy intensity for different building types in different locations and enable individual building performance to be measured and reported for each marketplace.

The benchmark must be localised to ensure climate and fuel supply equity, leaving the building carbon and energy intensity unchanged. Rather than estimating or trying to calculate the differences between urban centres, it simply measures against the average performance of buildings of the same type in the same urban centre. This is simple and equitable, and also keeps intact those elements that are critical for true carbon accounting, leaving the option open that the credits generated could be recognised under the Kyoto protocol and any post-Kyoto agreement.

Finally, both baselines and benchmarks are the key challenges for enabling the monetisation of carbon.

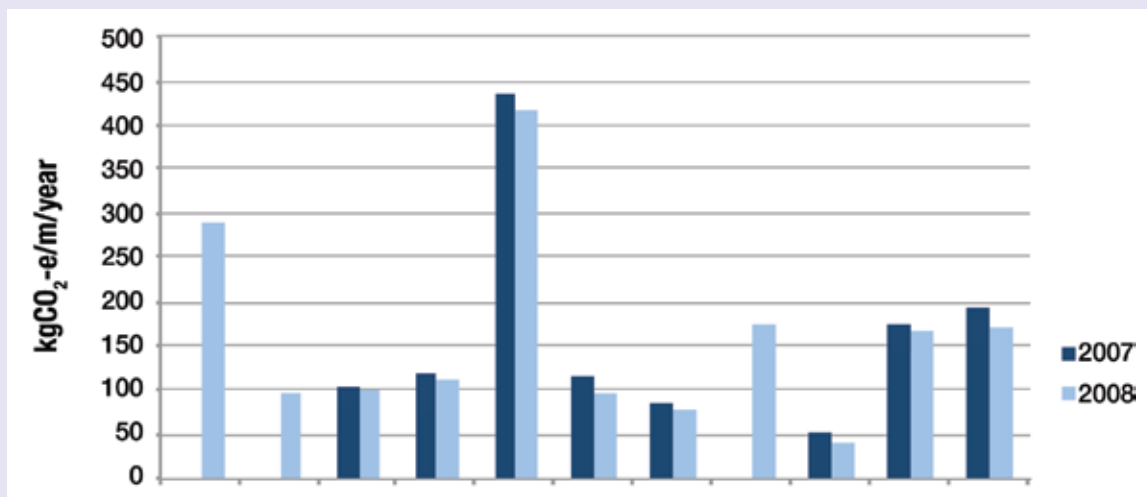
Targets & trajectories

Once there is a benchmark, targets and a medium-to-long term trajectory can be set which reduces over time to lower the average building’s energy consumption and GHG emissions. This trajectory provides certainty for the industry regarding expected market performance and, in order to maintain or improve asset value, this information will drive early action which could halve building emissions in our cities by 2020.

The trajectory also enables medium-to-long-term planning by cities and governments. Market performance against this target can also provide the environmental benefit of abatement initiatives and industry action.

Case study: UNEP-SBCI Member Lend Lease Group

In 2009 the Lend Lease Group engaged a consultant to undertake carbon footprints of all assets within one investment portfolio. The assets were studied as a total and also on a metre-squared basis creating a method of comparing assets of different size. As the table below shows, without a benchmark against which to analyse the assets’ performances, the data has little meaning or value.



By dictating the quantity of abatement to be achieved, but not how it is achieved, an aggressive trajectory will stimulate innovation in the building sector. This trajectory becomes the future building code benchmark.

Monetisation

Ultimately, a price on carbon in the building sector is what will stimulate substantial energy efficiency improvements quickly and cost-effectively across the industry.

By comparing a building's energy and carbon intensity against the trajectory, we can determine its performance against the benchmark. We can then apportion a reward or penalty accordingly. In other words, provide not just a 'carrot' but also a 'stick'.

For industry players committed to doing the right thing, there would be a financial return. But there would also be permits for inaction which would stimulate the whole sector to act to improve the performance of existing buildings:

1) Allocation of financial incentives for better-than-benchmark performance (grants etc.)

By enabling governments to accurately measure a building's performance in relation to a benchmark and trajectory, policymakers will have a credible basis for the allocation of government grants or fiscal incentives to kick-start the market.

Not only will financial incentives stimulate green refurbishment of buildings, but they will also enable trajectory or target-setting by national, state and city governments.

2) Mandatory improvements for existing buildings

While financial incentives will stimulate some green refurbishment, an effective incentive to maximise energy efficiency improvements across the non-residential building sector would be the introduction of a mandatory permitting obligation against the trajectories.

This is borne out by the experience of the Tokyo Metropolitan government which realised a two per cent reduction in GHG emissions from buildings through a voluntary trading scheme over some five years; in April 2010 it introduced the world's first cap-and-trade scheme for 1,400 buildings in the Tokyo Metropolitan area, and it is already set for expansion into neighbouring prefectures.

The data

In establishing a building-by-building carbon accounting system, the Common Carbon Metric project is guided by the imperative that the system is low cost, to ensure that the cost of measurement and monitoring does not exceed the value of carbon abated.

The basis of the metrics is simple:

- energy consumption (electricity and gas bills, including any on-site energy generation);
- building type (office, hotel, retail, school, etc); and
- location (climatic zone and/or economic centre).

From this data, we can easily calculate energy intensity (kWh/m²/annum); and from this carbon intensity

(tCO₂e/m²/annum using official GHG emission coefficients for the various fuel sources).

Although the current focus is on a sector reporting framework for energy use and GHG emissions, the same framework could be used for other environmental and social indicators such as water, materials, social impact or biodiversity.

Common ground in Cancun

Despite the sector's global collaboration and compelling arguments to prioritise the building sector in policies and programmes to reduce GHG emissions, the evidence is that only lip-service is paid to the sector's importance; in practice, the building sector has been overlooked by governments around the world.

“The building sector has been overlooked by governments around the world.”

As the Common Carbon Metric project tests and refines the metric, it's now time for governments to act. By formally recognising the abatement potential of the building sector as a top priority for achieving GHG emissions targets, the Parties would not only be paving the way for a global transformation of the sector but they would be unlocking a range of social and economic development opportunities.

Maria Atkinson is Chair of the UNEP-SBCI. She is the Global Head of sustainability for Lend Lease Corporation and has previously worked for the organisation in environmental management. She was the Project Environment Manager for the Sydney 2000 Olympic Village – a project internationally recognised for setting new benchmarks in environmental best practice for the construction and real estate sector. A recognised industry leader, she co-founded the Green Building Council of Australia where she served as founding CEO and is now a Life Fellow.

UNEP-SBCI is a global partnership of key stakeholders in the buildings sector, representing industry, business, governments and local authorities, research institutions and the civil society. Together, UNEP-SBCI Members and Partners work to promote sustainable building policies and practices worldwide, providing advice, tools and strategies to decision-makers.

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Evonik is building one of the world's most efficient hard-coal power plants in Duisburg, Germany.



Evonik Industries —

trailblazing climate-friendly technologies



Industrial development, innovation and the use of natural resources are still the main sources of prosperity for nations across the world. Yet rising demand from the 'new' economies of China and India and the needs of a predicted nine-billion-strong global population by 2050 will put the planet's finite resources under increasing strain. The strain will be intensified by climate change and the resulting challenges of global climate protection. Good ideas and practical solutions will be central to overcoming the trials ahead.

According to the Intergovernmental Panel on Climate Change (IPCC), by 2050 the industrialised countries need to cut greenhouse gas (GHG) emissions globally by as much as 80 per cent compared with 1990. Everyone – politicians, the corporate sector and, last but not least, every individual – is called upon to play a part. Evonik supports a broad-based, interdisciplinary approach to tackling these challenges. In Evonik's view, a global agreement on climate protection that sets comparable and binding targets and obligations for all contracting parties is critical. Without this, there is a risk of serious structural distortion of the business environment.

Evonik Industries AG is a market leader in the energy sector, chemicals and real estate. Based in Essen, Germany it has a presence in more than 100 countries and over 60 per cent of its business is generated outside of Germany. As an integrated industrial group, Evonik can use its specialist expertise to develop both sector-specific and wider-ranging solutions in an increasingly resource-constrained world. Therefore activities have been focussed on three megatrends: resource efficiency, health and nutrition, and the globalisation of technologies.

Resource efficiency across our business

Evonik's committed to improving energy efficiency at all process levels, from the generation of electricity and heat in its power plants through to a steady rise in the efficiency of its production lines in its chemical facilities and the development of energy-saving products for its customers. Many of its production facilities already meet top global resource efficiency standards. Nevertheless, by constantly reviewing processes and workflows further potential is identified for a sustained reduction in energy consumption or, for example, the consumption of cooling and processing water. Increased efficiency not only minimises our ecological footprint; it helps us keep costs in check too.

“Industrial development, innovation and the use of natural resources are still the main sources of prosperity for nations across the world.”

Evonik's chemicals sector has a presence in almost all important specialty chemicals markets and is a market leader in these segments worldwide.

As a grid-independent power generator, Evonik operates highly-efficient, coal-fired power plants in Germany, refinery power plants and a variety of

facilities to generate energy from renewable resources. Evonik engineers design, build and operate power plants all over the world and are experts in the modernisation of existing plants, retrofitting high-efficiency technology for a cleaner, more cost-effective energy supply. Evonik is recognised as a trailblazer in the area of the renewable energies, particularly in biomass, biogas, mine gas and geothermics.

Evonik: energy efficiency at work

Solar power

The solar energy sector is growing and has huge potential in the transition to a low-carbon energy matrix. But to sustain growth, the solar industry needs a specific form of silicon, called polycrystalline silicon, which more than 80 per cent of all solar modules are made from. Evonik is a global market leader in the production of polycrystalline silicon and its researchers have discovered a new route to solar silicon that consumes significantly less energy than conventional processes.

“The energy stored in the top three kilometres of the earth’s crust is more than enough to meet the world’s total energy demands.”

Evonik manufactures polycrystalline silicon through its joint venture Joint Solar Silicon (JSSi). JSSi uses a cutting edge energy-efficient process to produce silicon from silane. This method saves up to 60 to 80 per cent compared to conventional methods. In collaboration with SolarWorld AG and JSSi, Evonik started up a novel production plant for ultra-pure chlorosilanes in the Upper Rhine region in 2008. Ultrapure polycrystalline silicon is then transported from Rheinfelden to Freiberg, in Saxony, where SolarWorld employees melt it down to make ingots. These are then processed into rods and wafers for SolarWorld’s solar cells and modules.

Improving lithium-ion batteries

Lithium-ion batteries are state-of-the-art mobile energy sources. They have considerable advantages in hybrid and electric vehicles and can greatly reduce fuel consumption. The main advantages of lithium-ion batteries compared with lead and nickel-cadmium alternatives are their power density and longer lifecycle. Evonik produces SEPARION®, a ceramic separator found inside lithium-ion batteries, which increases the batteries’ operational reliability, making them ready for the mainstream market.

‘Clean coal’ technology

Evonik operates several large hard-coal power plants, both in Germany and abroad, and is a pioneer of modern coal-fired generating technology. Evonik’s vision of ‘clean competitive electricity from coal’ focuses on saving raw

Together with its partner SolarWorld, Evonik produces solar silicon by a new energy efficient process.



materials and increasing efficiency by using state-of-the-art technology to cut emissions from coal-fired power plants.

Evonik is currently building a coal-fired power plant with over 45 per cent net efficiency in Duisburg-Walsum, Germany. Once complete, it will be the most advanced hard-coal-fired power plant in Europe. Compared with older power plants, these facilities cut carbon dioxide and the consumption of coal by more than 30 per cent.

Renewable energies

Evonik is well-positioned in the fast-growing market for renewable energies. Several hundred thousand tonnes of matured timber are converted into electricity and heat in 10 of our biomass power plants. Evonik is also currently involved in three geothermal energy projects in Germany.

Using the earth’s heat

Theoretically, the energy stored in the top three kilometres of the earth’s crust is more than enough to meet the world’s total energy demands. Yet there are only a few places, such as Iceland, where the Earth’s heat reaches the surface. In other places, the warmth in the earth’s crust has to be tapped at depth.

Evonik is a leader in the planning, construction and operation of geothermally-sourced district heating systems and is committed to this carbon-neutral heat source. Geothermal heat can be used for district heating supply and for electricity production.

In Erding, near Munich, Evonik supplies public buildings, homes and factories with geothermal heat drawn from over 2,000m beneath the Earth’s crust. In Soultz-sous-Forêts, Alsace, the company is undertaking a research project investigating the scope for electricity production from geothermal energy.

Real estate: real potential for efficiency savings

Evonik’s real estate division is working on a wide range of pioneering solutions to optimise the energy efficiency

With the ceramic separator, Evonik has considerably improved the performance and safety of lithium-ion battery cells.



of Germany's existing housing stock and equip new buildings with modern, energy-efficient facilities.

An innovation in modernising old properties: the 'three-litre house'

The 'three-litre house' – named after the automotive industry's attempt to build a super-efficient, 'three-litre car', burning just three litres of fuel per 100km – is the result of an exciting pilot project undertaken by Evonik in Düsseldorf. The company has transformed an apartment block into one of the most energy-efficient buildings in Germany. Advanced building technology, smart ventilation, heat recovery and photovoltaic technology combine to bring energy savings of nearly 90 per cent for tenants, year after year.

The comfortable residential complex consists of 24 housing units built between 1964 and 1969 which look no different from others of their kind. But behind the renovated exteriors lies a sophisticated energy generation and utilisation concept that drastically reduces CO₂ emissions.

The residential buildings form part of an Efficient Homes project initiated by the German Energy Agency (dena) in collaboration with the German Federal Ministry of Transportation, Construction and Urban Development. The special feature of the three-litre house model is that, in addition to investing in insulation and passive windows, Evonik has developed a completely new building technology.

The refurbishment was completed last year with its own mini combined heat and power plant. The heat and power plant supplies the building centrally with heat and hot water. Tenants can then set the temperature in their housing units as they wish.

The primary energy requirement has been reduced from 286 kilowatts per hour (kWh) per square metre per year to just 36.2 kWh. The three-litre houses from Evonik are among the most energy-efficient, low-energy houses in all of Germany.

From research lab to market place

Evonik has established the Eco² Science-to-Business Centre under the auspices of our strategic research and development entity, Creavis Technologies and Innovation. The Centre is dedicated to interdisciplinary, cross-sector collaboration with university researchers, suppliers and customers along the entire value chain. The aim is to build up a competency network geared towards the energy efficiency megatrend and climate protection to turn visions into marketable, future-oriented products.

Evonik's cutting-edge products demonstrate the central role industry plays as the creator and enabler of smart solutions for the global climate and population challenges that lie ahead. To make further progress in the development of new technologies and raising efficiency, we need a strong and successful economy. Above all, a broadly based, research-oriented manufacturing sector is the vital prerequisite for a green economy. Unfortunately, the correlation between a competitive industrial base, employment and prosperity on the one hand and the necessary innovations in the development of new environmental technologies is often not presented transparently enough.

An innovative corporate culture, an holistic approach to the issues affecting society, and business practices that create value are the keys to our success. Without value creation, current and future challenges cannot be solved. However, value creation requires space for development and a reliable framework. That is particularly true for long-term investment decisions. Unilateral regional regulations distort the market and do not serve the interests of global climate protection or sustainable industrial development.

Whether Germany experiences a power shortage in 2020 or not, the ambitious climate goals of the German government will remain: To reduce CO₂ emissions by 40 per cent by the year 2020, and to increase the share of power generated by combined power and heat to 25 per cent, and by renewable sources to 25 to 30 per cent by the year 2030. It is in this context we are developing solutions that contribute to safe and sustainable energy supply – solutions that, like the three-litre car and the three-litre house, pave the way to the 'three-litre society.'

We believe in leading by example and drive forward energy efficiency in our own production processes through an intensive process of continuous improvement. Supported by internal management and process experts, we are working towards ways to bring sustained improvements in operational excellence across all sites and business units.

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Skylight, semi-transparent roof.



Adel El Gammal
Secretary General of the European Photovoltaic Industry Association (EPIA)

Photovoltaics – a cornerstone for a clean and democratic energy future

Incomplete or unfair economic comparisons of renewable energy with incumbent energy technologies can mislead citizens, says Adel El Gammal, secretary general of EPIA. It is imperative that the true benefits of decisively supporting renewables are fully explained. Harnessing the sun's energy as part of a renewable energy matrix is essential in mitigating global climate change and its catastrophic consequences: the development of a clean, sustainable and responsible green industry, creating millions of jobs across the world, is also crucial for ensuring a healthy socio-economic future.

International climate negotiations have entered a difficult stage following the Copenhagen climate conference (COP15) which failed to deliver a legally binding international treaty. Such a treaty would have provided investment security and a clear direction for the green transformation of the world economy.

Efforts of non-European countries to match or exceed European ambitions to address climate change have a decisive role to play in maintaining momentum and ensuring high-level political support for renewable energy promotion. The UN Framework Convention on Climate Change (UNFCCC) has been a catalyst, driving domestic policy debate and ensuring ambitious climate mitigation actions in developed countries such as Japan and Australia, and emerging economies such as India and China.

However, even if the pace of adoption for renewable technologies remains vigorous, there are mounting concerns about the stability of political support in these times of economic uncertainty. In addition, the long-term imperative of an accelerated adoption of renewables risks being undermined by short-term economic and political considerations backed by the intensive activity of the conventional fossil fuels and nuclear technologies lobbyists.

The formal UNFCCC negotiations will remain the only real hope for establishing a legally binding

international agreement supporting an accelerated transition to a low-carbon economy and address the global challenge of climate change.

Towards a new energy regime

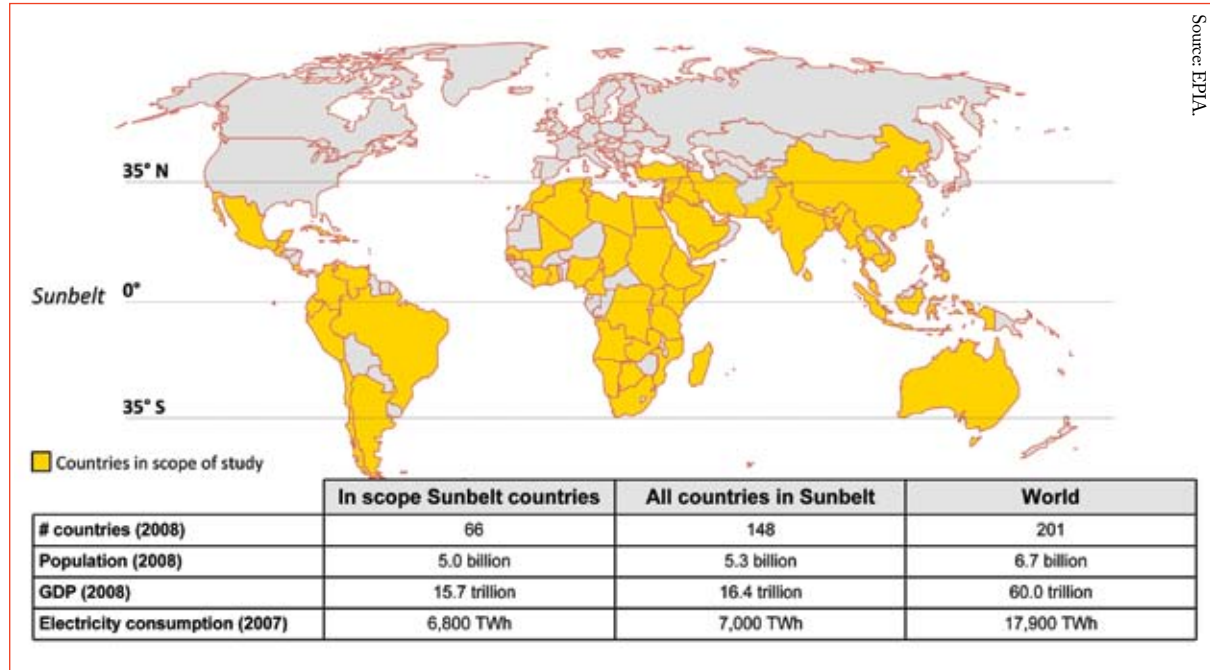
The only fuel used by photovoltaic (PV) technology is sunshine. The energy earth receives from the sun every year adds up to around 2,000 times global primary energy demand. The sun shines on virtually every lived-in place on the globe. And it is expected to do so for another five billion years.

PV technology has no material limitation whatsoever. Most PV cells today are built from silicon, the second most abundant material (after oxygen) in the Earth's crust. The energy-intensity of the materials used in PV is falling rapidly as the technology advances. Many solar panels today already have an environmental payback time of less than a year. This means that panels today which typically have a guaranteed lifetime of 25 years – and in most cases will continue to deliver electricity for much longer – will return the energy that was used to produce them within their first year of operation. With relentless technology advances, this payback time continues to shorten, making PV one of the best-in-class technologies in terms of greenhouse gas (GHG) abatement potential.

Pace of adoption has exceeded the most optimistic forecasts

Approximately 10 years ago, when the European Commission released its White Paper on renewable sources of energy, experts agreed on an ambitious target – described by many as visionary – for 3 gigawatts (GW) of PV capacity to be installed by 2010. Yet, last year alone, about 5.2GW of PV were installed in Europe where PV represented more than a fifth of all new installed energy

Sunbelt area: countries located within +/-35° latitude around the equator and countries in scope of study.



capacity propelling PV into the top three technologies, together with wind and gas.

A cumulative capacity of as much as 25GW of PV is expected to be installed in Europe by the end of 2010, representing more than eight times the original target. Over the last few years, the industry has shown a virtually limitless capacity to scale up and adapt to the skyrocketing demand for PV power. This year, no less than 15GW is expected to be manufactured, installed and commissioned worldwide.

PV panels are scalable from watts to megawatts and this offers a unique ramp-up capability. PV technology has a vital role to play in meeting soaring electricity demands worldwide while accelerating the transition to a low-carbon economy.

Mainstream by 2020: PV for the North and South, cities and countries

The *SET for 2020* study, released last year by the EPIA and realised with the support of the Strategy Consulting firm, AT Kearney, established for the first time the fundamental competitive potential of PV and analysed the possible penetration scenarios in Europe. A year later, despite the economic crisis, the market has developed beyond all expectation, setting PV projections in line with an accelerated deployment scenario where PV would alone cover about six per cent of the EU electricity demand by 2020. With the price reductions experienced over the last two years and the predicted changes to the electrical system that will enable it to accommodate a higher penetration of intermittent power, PV could potentially cover up to 12 per cent of the EU electricity demand by 2020.

In addition, while similar levels of penetration can be expected in other major Western economies, a massive penetration potential for PV also exists in countries of high solar irradiation.

An immense potential to be unlocked in 'sunbelt countries'

Countries of the 'sunbelt' (located within +/- 35° latitude of the equator) are home to about 75 per cent of the world's population and 40 per cent of global electricity demand. Critically, about 80 per cent of the forecasted growth of world electricity demand in the coming 20 years is expected to originate from emerging economies in that region.

Characterised by intense solar irradiation and, often, high electricity prices, countries of the sunbelt offer an exciting opportunity for PV, where the technology has unique competitive potential. Rolling out PV in these countries could make the targets for solar power – to become mainstream by 2020 and to constitute a major electricity source by 2030 – a reality.

A study by EPIA with the support of AT Kearney, *Unlocking the sunbelt potential of photovoltaics*, released in November 2010, looks in detail at 66 of the 148 countries which compose the sunbelt region, representing 5 billion people and 95 per cent of the area's population.

Despite the exceptional solar irradiation registered in these countries, they represent at present only nine per cent of the global installed PV capacity. Apart from China, all the top 10 major PV markets in the world are currently located outside the sunbelt region, which demonstrates the immense untapped potential of PV in the sunbelt countries.

With system prices expected to decrease by up to 66 per cent in 2030 compared to current levels, PV electricity, already competitive today with some peak generation technologies in a number of countries, would see its generation costs dropping. Costs could drop to a range of €0.06 to €0.12 per kilowatt hour (kWh) by 2020, making it highly competitive with all peak generation technologies, and as low as €0.04 per kWh in

2030, making it widely competitive with most generation technologies. PV will therefore constitute a highly competitive alternative for new generation capacity as well as for replacement of existing capacity.

The study, which looks in detail into the investment attractiveness and the competitive potential of PV for a given country, shows that the PV potential of the sunbelt countries could range, depending on the scenario, from 60 to 250GW by 2020, and from 260 to 1,100GW in 2030, representing 27-58 per cent of the forecasted global installed PV capacity by then.

Powering the smart cities of tomorrow

PV is much more than just another electricity source. It is highly scalable and can be used either in centralised solar plants or on a small-scale, for household or community level energy supply.

Being virtually the only truly distributed electricity generation source, PV constitutes a key driver towards a smarter future energy regime. The cities of tomorrow will integrate PV in their buildings, transforming them from today's primary source of GHG emissions into tomorrow's positive energy buildings, thereby becoming real distributed power plants.

Not only will distributed generation reduce grid losses and increase overall efficiency, it will further transform our entire relationship to power in a fundamental way.

The citizens of tomorrow will become consumers and producers of their electricity at the same time, so-called 'prosumers'. Their smart appliances, integrated within an intelligent global electricity system will enable them to optimise their electricity usage, changing their behaviour to take advantage of dips in demand and therefore lower prices.

Smart appliances will determine the optimal behaviour to deliver the required services. Excess generation at a given point will be dynamically compensated by excess load nearby, through the multidirectional capabilities of a smart grid, while electrical vehicles will constitute a huge distributed electricity storage capacity acting as an energy buffer within the entire electrical system.

External building walls, Surieux, France.



Source: TENESOL.

By controlling their complete energy footprint, city residents will become smart and responsible prosumers, and will enjoy the increased convenience and comfort provided by a smarter environment at the same time.

In Europe, the 190 million buildings represent about 40 per cent of the EU's GHG emissions. At the same time, in addition to the huge savings potential they represent through making them more energy efficient, they also represent an immense potential to become electricity power plants. Even utilising appropriate roofs and facades for PV – taking historical, architectural and orientation constraints into account – would alone represent the potential to generate about 40 per cent of the final EU electricity consumption by 2020.

On the other side of the spectrum, away from large cities and dense urban environments, PV also represents an exciting solution for powering smaller communities isolated from the country's backbone grid, through local mutualised mini-grids. Furthermore, PV offers a unique solution for providing clean and affordable energy to remote local applications, potentially supplying more than 1.5 billion citizens of this world (22 per cent of world's population) who currently have no access to electricity.

PV: pivotal in meeting future energy demands

There is increased awareness and consensus about the causes and the dramatic consequences of global warming. The need to establish a firm, mandatory long-term trajectory for a complete decarbonisation of our global economy has now emerged as an overarching imperative to preserve human civilization as we know it.

In Europe, *RE-Thinking 2050* – a study carried out by the European Renewable Energy Council (EREC) and co-authored by EPIA – demonstrates that a 100 per cent renewable scenario for the EU electricity sector by 2050 is not only feasible but highly desirable environmentally, economically and socially.

The study establishes that, thanks to its high competitive potential, PV, within a fully renewable generation portfolio, could provide more than 25 per cent of the forecasted electricity demand in Europe by 2050.

On a global perspective, *Solar Generation VI*, a flagship study undertaken jointly by the EPIA and Greenpeace, has analysed the potential contribution of PV to the world's power generation by 2050.

It highlights that, while PV deployment today remains concentrated in a few developed economies, most of which enjoy relatively modest irradiation conditions, PV has massive competitive potential in major developing economies, most of which enjoy superior solar irradiation. It establishes PV as a major contributor to future power generation worldwide.

Considering a range of long-term assumptions, the study shows that PV could cover between 11 per cent and 21 per cent of worldwide electricity demand by 2050. This double-digit penetration is also confirmed by an independent reference study, *PV Technology Roadmap*, recently released by the International Energy Agency (IEA).

Solar Power Plant, El Dorado, Nevada USA.



Source: First Solar

Unleashing PV power: a universal, unlimited and affordable clean electricity source

PV has demonstrated its ability to make a major contribution to the transition of our energy sector to a low-carbon regime.

Despite active resistance from lobbies of conventional fuels and technologies, PV has been able to prove its unique benefits, even through the prism of our current economy paradigm characterised by hugely distorted energy markets and operated by deficient instruments.

The current paradigm of fossil fuels fails to address the catastrophic consequences for humankind. By contrast, PV has established itself as a credible, affordable and readily available technology, with huge promises in terms of environmental protection, economic competitiveness and socio-economic development. Its unique fundamentals make it a catalyst for a new smart and distributed energy regime and a strategic technology to address the future energy needs of the world.

PV: what next

As COP15 did not deliver the promised legally binding international treaty, hopes now rest with COP16 to achieve at least a balanced package of measures on a long-term, shared vision of adaptation, mitigation, technology transfer and financing.

Emission reduction targets for all: International climate negotiations need to establish a clear, transparent and stable framework for supporting an accelerated transition to a global low-carbon economy. Such a framework should establish ambitious mid- and long-term emission reduction targets for developed countries while fostering immediate, ambitious voluntary emission limitations in developing economies.

Long-term carbon pricing mechanisms: The framework should fully acknowledge the externalities of fossil fuel use by establishing credible and reliable long-term carbon pricing mechanisms, while encouraging redirection of existing support to fossil fuels towards renewables.

Risk-sharing funding models for renewables: Appropriate financial mechanisms and dedicated instruments should be developed to create a stable investment environment. New risk-sharing models are necessary if we are to mobilise the huge capital required

to finance the unprecedented scale of infrastructure needed for a complete energy transition.

Technology transfer for developing world: Technology transfer mechanisms are required for the wider, accelerated adoption of renewable technologies in developing countries. The PV industry needs to build capacity to serve these emerging markets while committing to local capacity building by investing in local manufacturing capabilities and establishing local service offerings.

PV inclusion in energy strategies: National governments and policymakers must understand the socio-economic benefits of transitioning to a renewable economy by including PV as an explicit part of their energy strategy and planning. They should also collaborate with development banks and private financial institutions to facilitate technology adoption.

Power utilities need to capitalise on the strengths of PV to increase peak power generation and strengthen the resilience of grids by distributed PV generation assets. At the same time, they must fully leverage such an opportunity to leapfrog where possible expensive backbone grid development. More than 40 international associations active in the solar and renewable energy sector have joined forces to speak with a unified voice at COP16, to demonstrate the capacity of PV to deliver massive CO₂ reductions and thereby decisively contribute to the fight against climate change.

The technology is here, now, at our disposal. It is our collective mission to unlock the full potential of PV and deliver on the promises of a clean, democratic, responsible and sustainable energy future.

Adel El Gammal is Secretary General of the EPLA and also active in several PV and renewable energy organisations including the EREC. A civil engineer, he has led several studies on the future of PV, such as the 'SET For 2020' report, a reference study establishing the roadmap for PV in Europe by 2020 and beyond. Prior to joining the renewable energy sector, he held various international executive positions within leading multinational companies in the fields of management consulting and IT services.

The EPLA is the world's largest photovoltaic industry association with over 220 members from across the sector. EPLA members are present throughout the whole value chain, from silicon, cells and module production to systems development and PV electricity generation as well as marketing and sales.

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Naturally trees capture carbon dioxide but CCS projects are now being developed to help this process.



Nobuo Tanaka
Executive Director of the International Energy Agency

CCS: an essential element in achieving climate goals

Carbon capture and storage (CCS) technology – whereby CO₂ emissions from industry are captured and sequestered underground to limit their global warming potential – has a very significant role to play worldwide in reaching global carbon emissions targets, says Nobuo Tanaka, executive director of the International Energy Agency. It is vital that governments move now to increase their investment in research and development (R&D), in mapping potential CO₂ storage locations and then implement CCS technology across a number of industrial sectors.

Fossil fuels presently account for 81 per cent of global primary energy supply, and 68 per cent of global electricity production. Given energy demand trends especially in non-Organisation for Economic Cooperation and Development (OECD) countries, fossil fuels are expected to remain a significant portion of the energy mix through to 2050, even as alternative energy sources grow rapidly.

The energy sector accounts for more than 80 per cent of global CO₂ emissions and 60 per cent of all greenhouse gas (GHG) emissions. To prevent significant climate change, global CO₂ emissions must be halved by 2050. Can this reduction be achieved while we are still so dependent on fossil fuels? The answer is yes, but we will need all energy technologies, and the broad deployment of CCS in both power and industrial sectors must play a key role.

According to *International Energy Agency Energy Technology Perspectives 2010*, CCS contributes significantly

to the least-cost route of reducing and stabilising CO₂ emissions in the atmosphere, representing 19 per cent of total emissions reductions in 2050 in the BLUE Map Scenario (which aims at halving energy-related CO₂ emissions by 2050). Yet the world needs to better understand the role of CCS in a sustainable energy future. Incentives must then be put in place to encourage CCS investment globally.

The last few years have seen increasing interest in CCS technologies at the highest political levels. At their Gleneagles Summit in 2005, the G8 Leaders committed to “work to accelerate the deployment and commercialisation of Carbon Capture and Storage technology”. In 2008, the G8 Leaders recommended that 20 large-scale CCS demonstration projects should be launched by 2010 with a view to beginning broad deployment of CCS by 2020.

The ‘Roadmap’ for CCS

To further detail the pathway to CCS deployment, the International Energy Agency in 2009 published a CCS roadmap with the following findings and recommendations:

- To achieve its GHG mitigation potential, some 100 large-scale CCS projects are needed globally by 2020 and over 3,000 projects by 2050, equalling an additional investment of over US\$2.5–3 trillion from 2010 to 2050;
- Although the developed world must lead the CCS effort in the next decade, CCS technology must also spread

rapidly to the developing world. This growth will require expanded international collaboration and financing for CCS demonstration in developing countries at an average annual level of US\$1.5 to 2.5 billion from 2010 to 2020. To provide this funding, CCS needs to be approved in the Clean Development Mechanism (CDM) or an alternative financing mechanism;

- CCS is more than a strategy for 'clean coal'. CCS technology must also be adopted by many industrial sectors such as cement and iron and steel;
- CO₂ capture technology is available today, but the associated costs need to be lowered and the technology still needs to be demonstrated at commercial scale;
- CO₂ transport via pipeline has been proven; the challenge for the future of transport technology is to develop long-term strategies for CO₂ source clusters and CO₂ pipeline networks;
- There is an urgent need to advance the state of global knowledge of CO₂ storage capacities. While depleted oil and gas fields are well-mapped and offer promising low-cost opportunities, deep saline formations are the most viable option for the long term. However, only a few regions have adequately mapped the CO₂ storage potential of these formations;
- While some regions have made important progress in developing dedicated legal and regulatory frameworks for CCS, most countries still have issues to address before significant progress can be achieved;
- Local communities have legitimate concerns about CCS that must be addressed. Governments need to take the lead on developing community-tailored CCS public engagement strategies, ensuring early provision of information about the costs and benefits of planned CCS projects compared to other GHG mitigation options.

CCS is needed, especially in the large emerging economies.

Since the 2008 G8 recommendations and the 2009 International Energy Agency CCS Roadmap, the progress made has been visible but at the same time varying. Although the 2008 G8 goal of launching 20 large-scale CCS demonstration facilities by end of this year is unlikely to be met, significant progress has been made towards launching demonstration plants across the globe. A report by the International Energy Agency, the Carbon Sequestration Leadership Forum (CSLF), and the Global CCS Institute, presented to G8 leaders at their June 2010 Summit in Muskoka, Canada, provides analysis of the progress and points to the need for accelerated action by governments and industry.

In the spring of 2010, the Global CCS Institute identified 80 large-scale integrated demonstration projects at various stages of development around the world, many of them having been initiated only during the past two years. These projects are located primarily in Europe, the US, Australia, Canada and Korea. Seven of the projects are in non-OECD countries: four in

China, two in the Middle East and one (in operation) in Algeria. While this activity outside the OECD, where growth in fossil fuel demand is expected to be strongest, is promising, there is no room for complacency: large-scale CCS development in non-OECD countries must accelerate if CCS is to deliver on its potential.

Overall, around two-thirds of currently planned projects are in the power generation sector. Other industrial projects include those associated with the separation of CO₂ from natural gas. However, there are unfortunately a very limited number of projects related to the cement, aluminium and iron and steel industries. Clearly more projects need to be developed in these sectors, as CCS is often the only solution for them to achieve deep cuts in CO₂ emissions. According to the International Energy Agency roadmap, in 2050 up to 45 per cent of global CO₂ captured will come from sources other than power generation. Demonstration and deployment of CCS in industrial sectors is therefore critical. Some R&D and demonstration initiatives are underway, but we urge reinforced cooperation between industry and governments on demonstrating CCS on industrial applications.

Governments making progress with CCS

Significant progress has also been made by governments. Over the past two years, a number of governments and organisations (notably Australia, Canada, Japan, Norway, the Republic of Korea, the US and the EU), have committed substantial funding and are actively facilitating the deployment of large-scale CCS demonstration projects. They have to date announced support for 19 to 43 large-scale integrated projects before 2020, with public funding commitments rising to between US\$26.6 billion and US\$36.1 billion. These commitments, however, are generally contingent on industry taking a full and active role.

International Energy Agency analysis backs the general agreement that CCS is needed, especially in the large emerging economies such as Brazil, China, India, Indonesia and South-Africa. In these countries, progress has so far been mixed, with limited CCS activity in many of them to date, due mostly to lack of clear incentives and financial support. China, however, has made notable progress. In addition to extensive R&D activity, China has demonstrated CO₂ capture on two coal-fired power plants and has begun construction on the first phase of the GreenGen project, a three-phase project to demonstrate CCS on a commercial-scale Integrated Gasification Combined Cycle (IGCC) plant. The potential for deploying CCS has been studied in Indonesia and projects are also being planned in Brazil, in addition to their active R&D programme.

Launching concrete projects requires enabling legal frameworks. Much progress has been achieved in the legal and regulatory area. In the EU, the directive on the Geological Storage of CO₂ and the EU Emissions Trading Scheme directive provide a framework for legislation and regulation of CCS within the region. In Australia, comprehensive CCS legislation has been put in place at the federal level to cover offshore storage and, in a number of states, to cover it onshore.

In the US, a number of states have implemented CCS legislation in parallel with ongoing work at the

federal level by the Environmental Protection Agency. In addition, a number of other countries have begun the process of reviewing and amending legislation, including Canada, Japan and Norway. The first to establish legal frameworks have generally been OECD countries. It is now important that the large emerging economies start developing legal and regulatory frameworks.

CCS – the challenges

Despite significant progress towards launching demonstration and in establishing legal frameworks, significant challenges to CCS remain. The first concerns storage. Recent International Energy Agency analysis indicates that some 120 Gigatonnes (Gt) of CO₂ must be captured and stored globally over the next four decades – an indication of the storage capacities that need to be explored, characterised, licensed, safely operated and finally closed. The status and availability of data on CO₂ storage vary significantly around the world which is potentially a major constraint to rapid, widespread CCS deployment. In regions with the potential to store large volumes of CO₂, a concerted effort is required to map and characterise suitable storage formations. This work should have a long-term perspective that takes into account expansion from demonstration to wider deployment.

Several countries, including Australia, Canada, Japan, Mexico and the US, as well as the EU, have started to map storage potential and create storage capacity databases, in order to align CO₂ sources and storage sites. This work must however be accelerated. We see a strong role here for governments in the early stages: while the development and operation of storage sites are best left to industry, the mapping of storage potentials and capacities and characterisation of sites could well be led by government bodies.

A second challenge concerns the forms of international CCS cooperation itself. While the G8 has facilitated discussions on CCS over the past five years and provided a forum for high-level political dialogue, its future as a regular energy discussion platform is uncertain, due to the ever-changing nature of global economic and political issues. Will energy minister cooperation provide an alternative? The first Clean Energy Ministerial (CEM) meeting in July 2010 in Washington DC convened energy ministers and high-level ministry officials from 25 countries plus the European Commission to discuss low-carbon energy technology and policy, including issues surrounding CCS. The International Energy Agency supports this initiative and hopes that it can deliver political momentum to deal with key challenges not only for CCS, but for a range of clean energy technologies and policies.

But by far the most important and fundamental challenge facing CCS is directly linked to the UN Climate Change conference in Cancun. Capturing and storing massive volumes of CO₂ will only become a profitable activity on a large scale if there is a globally adopted, verified and sanctioned agreement by which governments commit to binding cuts of CO₂. Under the Copenhagen Accord, countries recognised that deep cuts in emissions are required, “so as to hold the increase in global temperature below 2 degrees Celsius”, but the Accord stopped short

of actually delivering a binding agreement. We now look forward to negotiations resulting in such an agreement.

While both OECD and non-OECD countries will have to take on differentiated targets and mechanisms, it is critical to ensure that CCS can be developed and deployed in all parts of the world in a cost-effective manner. Our analysis from the CCS Roadmap shows that very rapidly, just after 2020, over half of the large-scale projects should be developed in non-OECD countries. Therefore CCS must have a clear role in post-2012 climate change arrangements. Governments must maintain their efforts to ensure that CCS is not excluded from the incentive mechanisms under post-Kyoto arrangements. Without access to such mechanisms, it is unlikely that the deployment of CCS will expand at the pace required in developing countries. Effective incorporation of CCS in the Kyoto Protocol's CDMs, and any subsequent mechanism, would represent an important first step.

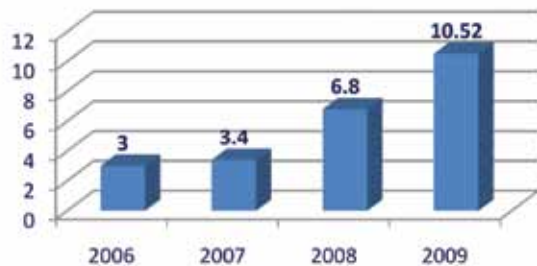
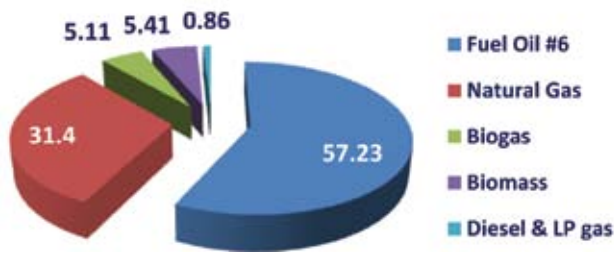
In summary, we must rapidly test and demonstrate CCS. Simultaneously, we must take steps to ensure deployment of CCS in OECD countries, and increasingly beyond the OECD. This calls for concerted action by industry and governments in all parts of the world. To halve our energy-related CO₂ emissions in the next four decades, a portfolio of solutions is required, ranging from energy efficiency, nuclear energy, renewables and CCS. We believe the world cannot cost-effectively halve its CO₂ emissions without CCS.

***Nobuo Tanaka** is Executive Director of the International Energy Agency and a former Director of Science, Technology and Industry at the OECD. He began his career in the Ministry of Economy, Trade and Industry (METI) in Tokyo before joining the OECD in 1989. In 1995, he returned to METI where he was Director General of the Multilateral Trade System Department in the Trade Policy Bureau. He has led Japan's involvement with the International Energy Agency and has helped formulate both international strategy as well as domestic environment and energy policies for Japan in the Kyoto COP3 negotiations.*

*The **International Energy Agency** is an intergovernmental organisation which acts as energy policy adviser to 28 member countries in their effort to ensure reliable, affordable and clean energy for their citizens. Founded during the oil crisis of 1973–74, the organisation's initial role was to coordinate measures in times of oil supply emergencies. Its mandate has now broadened to incorporate the 'three E's' of balanced energy policy making: energy security, economic development and environmental protection. Current work focuses on climate change policies, market reform, energy technology collaboration and outreach to the rest of the world, especially major energy consumers and producers such as China, India, Russia and the Organization of the Petroleum Exporting Countries (OPEC).*

Email: info@iea.org

Main fuels used in the brewing boilers (%).



Percentage of renewable energy.

Brewing beer by-products into energy



Mexico's leading beer company, Grupo Modelo, is using the spent grain from beer production as a green alternative to fossil fuels. Grupo Modelo has over 60 per cent of Mexico's domestic beer market and also exports well-known brands such as Corona Extra to the UK, US and Canada. A strategic objective for the company is the gradual and progressive substitution of fossil fuels for renewable energy.

Spent or waste barley malt from beer production consists mainly of fibre, husks and protein. It contains no hazardous chemicals and is often used as cattle feed.

This process that transforms spent grain into alternative energy is carried out at Grupo Modelo's brewery in Zacatecas, Compañía Cervecería de Zacatecas, a brewery that has an annual installed capacity of 20 million hectolitres.

The concept, design, equipment acquisition, installation, tests and start up of the project took approximately two years. The spent grain burning system was commissioned in mid-2008.

Steam and electrical energy are required by both the beer production process and the service areas. The former process is carried out in boilers that use fuel oil and biogas produced by the anaerobic process of waste water treatment. Steam is used for indirect heating in the brewing process and for electrical energy generation by steam turbines.

The goal is to use spent grain as an alternative fuel for the generation of steam and electrical energy required by the Zacatecas brewery. After mashing the grains to produce the liquid 'wort' that will eventually become beer, the spent grain has a moisture content of 80 per cent. The grain is then dried to reduce moisture levels to less than 25 per cent before it is introduced into the boiler.

Emissions generated by the combustion of spent grain do not increase the potential for global warming. Instead the fuel can be seen as carbon neutral as the carbon emitted is the same carbon absorbed during photosynthesis in the growing stages of the barley. Moreover, since this by-product contains almost no sulphur – 0.34 per cent compared to

an average of four per cent for fuel oil – sulphur dioxide concentration in combustion gases also decreases.

Benefits of the project:

- Decrease in emissions by approximately 70,000 tonnes of CO₂ per year;
- 20 per cent annual savings in fuel oil consumption when using 100 per cent of the spent grain generated by beer production;
- Use of by-products of the brewing process as alternative fuel and renewable energy source;
- Increase in the generation and recovery of biogas (methane) as an alternative fuel in boilers.

Grupo Modelo, founded in 1925, is Mexico's market leader in beer production, distribution and marketing, with 63.3 per cent of the total (domestic and export) market share, as of December 2009. It has an annual installed capacity in Mexico of 65 million hectolitres. It brews and distributes 13 brands, including Corona Extra, the number one internationally reknowned Mexican beer, Modelo Especial, Victoria, Pacifico and Negra Modelo. It exports six brands throughout 160 countries. It is the importer of Anheuser-Busch Inbev's products in Mexico, including Budweiser, Bud Light and O'Doul's. It also imports the Chinese Tsingtao brand and the Danish beer Carlsberg. Through a strategic alliance with Nestlé Waters, it produces and distributes within Mexico the bottled water brands Santa María and Nestlé Pureza Vital, among others. Grupo Modelo has traded in the Mexican Stock Exchange since 1994 (GMODELLOC). It is also quoted as an ADR under the ticker GPMCY in over the counter markets and in Latibex in Spain as XGMD.

Website: www.gmodelo.com

Middelgrunden Offshore Wind Farm, Copenhagen, Denmark.



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Why wind power will lead the low-carbon energy supply of the future



Professor Arthorous Zervos
President of the European Wind Energy Association (EWEA)

Wind power provides a green, never-ending power supply, writes Prof Arthorous Zervos, President of EWEA. Wind is one of the world's most abundant energy resources, it does not emit harmful greenhouse gases, nitrogen oxides (NOx) nor other air pollutants, and it uses no water during operation. It can be scaled up relatively rapidly and start reducing carbon emissions with immediate effect. In Europe, wind power has made the shift into the mainstream. It is a proven technology and must be harnessed further if the region is to meet its carbon reduction targets.

Slowly and, in many cases, reticently, the world is waking up to climate change, but world leaders are yet to go the extra mile in carbon reductions that could keep global warming in check.

The Intergovernmental Panel on Climate Change (IPCC) has stated that global greenhouse gas emissions will have to peak by 2015 and decline thereafter. If we do not start cutting carbon now, unchecked global warming could wreak havoc worldwide.

In a recent study, scientists found that people alive today could live to see a 4°C rise in temperatures over pre-industrial levels which could endanger the water supply of 50 per cent of the world's population, lead to the extinction of as many as half of all plant and animal species, raise the frequency of freak weather conditions and cause widespread flooding of coastal areas. The study, carried out

by the Met Office in the UK, also found that in some areas – namely the Arctic, and Western and Southern Africa – temperatures could rise by up to a staggering 10°C.

All this could happen if we fail to dramatically reduce the quantity of carbon we emit by burning fossil fuels. We are currently burning carbon on a massive scale for our industry, transport and domestic needs. In the short time frame scientists are talking about, it seems obvious that we must use the climate-saving technologies we have at our fingertips on a vast scale. In this context, wind energy is one of the strongest tools the world has against climate change.

The more advanced developing countries must end the use of fossil fuels and move rapidly to a renewable energy economy – one in which wind power will play a strong role supported by other renewable energies.

European Union sets the example on climate change policies

In the EU, we are fortunate to be where the world's most advanced policies against climate change have already been put into action. Two targets – the first to cut carbon emissions by 20 per cent by 2020, the second to see renewable energy comprising 20 per cent of the total energy mix – are significant steps forward for the protection of our planet. Implicit in the latter is the need to increase the share of renewable electricity to at least 34 per cent before 2020.

Europe has an established wind power sector which is already helping to fight climate change.



© Creative commons/flickr/Snap Shock

Europe has an established wind power sector which is already helping to fight climate change: over the course of 2009, wind energy meant avoided emissions of more than 100 million tonnes of CO₂. By 2012, wind will avoid the emission of 146 million tonnes of CO₂ per year, rising to 333 million tonnes by 2020.

While we are heading in the right direction, there is no hiding from the fact that last year, at the UN COP15 summit in Copenhagen, we failed to seal a groundbreaking and ultimately planet-saving deal. I was disappointed that the EU's targets and its offer to increase its carbon cutting target to 30 per cent if other countries signed up to carbon reduction moves failed to spur other nations into action.

Even without the rest of the world on board, Europe should strive for a 40 per cent carbon reduction target compared to 1990 levels. At least three-quarters of these cuts should be made within Europe and not offset in countries outside of the EU. Currently there is much talk at the highest echelons of political power about deeper cuts but we are yet to see any concrete action.

Wind power has already yielded massive carbon savings

Over the last 10 years, the biggest transition in the history of modern wind power has taken place: it has been transformed from a minor electricity source to a mainstream one. Today, in some EU countries, wind meets a substantial proportion of national electricity needs, with Denmark taking the lead with over 20 per cent (IEA figures for 2008). In Portugal, wind power meets 15 per cent of the national electricity demand, in Spain, 14.4 per cent and in Ireland wind power meets 10.5 per cent, according to the latest International Energy Agency (IEA) figures for 2009.

For the EU as a whole, wind currently meets five per cent of the electricity demand, and we are looking to boost that to 14-17 per cent by 2020 and to 50 per cent by 2050.

One of the most frustrating elements of the global resistance to take action on climate change is that we have a mature and proven technology available that will contribute massively to cutting carbon, and is already doing so in many countries around the world. Europe is the pioneer and world leader of the modern wind power industry, and China, India, Japan, South Korea and the US are also significantly building up their wind power sectors. But, even in Europe, we are still too far away from a renewable energy economy that really would help protect the planet from climate change.

Looking back over the last decade, it is clear that wind power is the technology that has easily contributed the most to carbon reductions in the power sector. The world installed more new wind power capacity last year (37.5 GW) than it installed new nuclear capacity in the last decade (28 GW). In Europe, wind power has been the leading power-generating technology for new installations for the past two years. Last year, some 39 per cent of all new capacity installed was wind power, followed by gas (26 per cent), and solar photovoltaics (17 per cent). In total, 62 per cent of all new capacity was renewable while, during the same year, Europe decommissioned more coal and nuclear capacity than it installed.

None of the other so-called 'low carbon' technologies could achieve growth rates as seen in the wind sector. While both carbon capture and storage (CCS) and nuclear are much talked about, it is important to note that no CCS plant has ever been built, and it takes more than a decade to build a new nuclear energy reactor. Neither CCS nor nuclear are solutions to climate change feasible within the 2020 timeframe in which our current targets are set.

Wind power is needed now

With 2020 just 10 years away – the year by which Europe should have achieved its 20 per cent renewable energy target – we need to act now with technologies that have been proven to work.

In a recent publication, *EU energy trends to 2030*, the European Commission says that it expects 333 GW of new electricity generating capacity to be installed in the EU between 2011 and 2020, of which wind could account for 136 GW – or 41 per cent of all new installations. The publication states that wind energy will produce 14 per cent of the EU's electricity by 2020 – almost treble current levels.

The Commission's expectations are in line with the current reality and industry expectations: Wind energy capacity will reach 222 GW in 2020, the Commission says, while the EWEA's target for the same year is a small amount ahead at 230 GW, which will produce 14-17 per cent of the EU's electricity depending on total demand.

These statistics are proof that wind power is already achieving and can achieve more. It is a real and green alternative to fossil fuels and, crucially, it can be deployed and begin reducing CO₂ emissions immediately.

Europe-wide electricity grid

In the coming years, Europe's first priority for the renewable energy sector is a pan-European electricity grid that interconnects countries and offshore wind farms, bringing vast amounts of green electricity online. While the offshore wind energy industry is still in its infancy relative to its onshore sister, EWEA foresees that the 2020-2030 period will see a significant growth in offshore wind energy. This requires a substantial shift from the national structures in place today to a truly European model.

By 2050 in Europe, wind power will cover around 50 per cent of the market for power, pushing the more expensive and carbon-price exposed fossil fuel technologies out of the market.

At the same time, an integrated and fair European power market is vital for the development of all renewables. The EU's recently agreed 'third liberalisation package' is working towards unbundling the production and transmission assets of all electricity companies but this policy is yet to be rolled out across Europe. Such a move would introduce competition and create a level playing field in the European electricity market. Not only will the environment reap the benefits with more green electricity online, but prices for consumers will fall as wind power pushes more expensive technologies out of the market thanks to its low marginal cost, Europe's energy security will be assured and thousands of jobs will be created.

Further measures, such as reduced gate-closure times – allowing wind power producers to give production forecasts as close to real time as possible, and an intelligently managed smart grid using demand-side management and storage capacities, should also be put in place.

Looking ahead to 2050

Last year the G8 agreed to cut carbon emissions by 80 per cent on a global scale by 2050. While that seems like a long way off, we must take the right decisions today that will make that target possible. If we are to take the 80 per cent target seriously, the power sector cannot emit any CO₂ by that time. The remaining 20 per cent of emissions need to be allocated to other sectors, principally agriculture and transport – aviation in particular – where it is technically very difficult to achieve zero emissions.

To make a 100 per cent cut in carbon emissions from the power sector possible, and in order to account for the 20-30 year lifespan of the average power plant, we

must take the simple decision to stop building new carbon-emitting power stations by 2020. The most straightforward way to achieve this is by banning carbon emissions in the power sector from 2020 and to allow market forces to decide which technology will take precedence.

By 2050 in Europe, wind power will cover around 50 per cent of the market for power, pushing the more expensive and carbon-price exposed fossil fuel technologies out of the market.

However, many stakeholders are pushing for a combination of renewable energy, nuclear energy and CCS to achieve a zero-carbon power sector by 2050. They will argue that we need all technologies to decarbonise our power sector. This is not correct. Renewable energy can do it alone with a massive contribution from onshore and offshore wind energy.

Professor Arthouros Zervos is President of the EWEA and President and CEO of Greece's Public Power Corp, the country's biggest company. With Zervos at the helm, Greece hopes to raise renewable energy output and has plans to generate 20 per cent of its energy from renewable sources by 2020, up from the current level of three per cent. Zervos has been committed to wind energy since the early 1980s and is a world expert in this field. He also represents the broad spectrum of renewable energies in his role as chairman of the European Renewable Energy Council (EREC).

The EWEA is the voice of the wind industry, actively promoting the utilisation of wind power in Europe and worldwide. It has over 600 members from nearly 60 countries, including manufacturers with a combined 90 per cent share of the global wind power market, component suppliers, research institutes, national wind and renewables associations, developers, contractors, electricity providers, finance and insurance companies. This combined strength makes EWEA the world's largest and most powerful wind energy network. EWEA coordinates international policy, communications, research and analysis and provides various services to support members' requirements.

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Website: www.ewea.org*

LEADING THE ENERGY CHANGE

Climate change adaptation, a crucial component of our Sustainable Development Policy

The development of the EDF Group adaptation strategy started from the premise that the Earth's climate is changing. The full range of impacts may not yet be fully understood, but the climatic evolution has started and mitigation measures will be, in the short term at least, insufficient to stop it.

EDF Group devised an adaptation strategy that focuses on the principal challenges that lie ahead up to 2100.

We assumed a range of plausible long-term climate and economic scenarios to create a description of the likely effects on natural systems and processes.

MITIGATION VERSUS ADAPTATION

The most important means of minimizing the impacts of climate change, and thus the need for adaptation, is to limit and reduce greenhouse gas emissions at the global scale as early as possible.

EDF Group is the world's number one nuclear energy company and Europe's number one hydro-power company.

Our existing electricity generation fleet has the lowest carbon intensity of all major European energy companies.

We believe that low-carbon electricity generation has a vital role to play in cutting global carbon emissions, and we are leading this energy change.

However, climate scenarios show no significant downturn in the current global-warming trend for decades to come, even if drastic action were to be taken immediately at a global scale. So, whilst our business strategy focuses on climate change mitigation through widespread adoption of low-carbon generation, we must also prepare ourselves for the impacts of climate change that will occur.

Indeed, EDF has already started to make significant changes to its operations in response to changes to the climate that have already occurred.

CLIMATE IMPACTS

Climate change, observed and foreseen, influences EDF's activities in a variety of ways through impacts on existing installations, organisations, markets and stakeholders.

For example, many of our nuclear and thermal power stations use river water for cooling and discharge warm water back into rivers, a heavily regulated process. Hotter summers would increase river temperatures limiting our authorization to discharge warm water.

A warmer but more turbulent climate would also impact our distribution networks. Warmer summers would decrease efficiency, and stormier winters would cause more structural damage.

And we are already seeing our customers' demands change with more people using air-conditioning in summer. As a result, electricity demand in some markets peaks in the summer rather than in winter, reversing the historical trend. This has consequences for maintenance planning and for network reinforcement.

Adaptation to climate change refers to the capacity of EDF's main activities to adjust to these changes, either through minimizing the adverse impacts or by taking advantage of the benefits.

A proper adaptation strategy needs to take into account all of these aspects and to prioritize them.



EDF'S CLIMATE CHANGE ADAPTATION STRATEGY

Launched in 2010, EDF's adaptation strategy comprises 10 key points, implemented through action plans within each Group business line or company.

■ Gaining access to relevant and sufficient information

- Produce and exchange the right climate-related data and launch a joint project of databases for our businesses.

■ Adapting existing facilities certain to stay in the landscape for a long time

- Adapt our facilities, operating processes, in addition to our Climate Hazards Plan.

■ Mainstreaming the expected consequences of climate change into our design of future assets and facilities

- From the onset of the design phase, the future climate is one of the design parameters for future power-generation facilities.

■ Boosting our resilience to extreme climate events through direct application of our Climate Hazard Plan – Preparing for crisis management

- Prevent an extreme climate event from having catastrophic impacts, and return to initial status as early as possible.

■ Adapting our offers to climate change

- Based on consumer needs, also affected by climate change.
- Factor in new uses, in particular smart grids and electric vehicles.

■ Adapting our internal operations and expertise to climate change

- Adapt the working environment and skills.

■ Activating the right R&D to address the right topics

- Deliver information on the latest breakthroughs about the predictable effects of climate change.
- Provide support to define their impacts on our facilities and organisations.
- Contribute to the construction of our future asset base.

■ Mainstreaming national and international solidarity when implementing our adaptation measures

- Solidarity in energy issues, and consequently in health issues as well.

■ Incorporating knowledge breakthroughs into our strategy

- Initiate and monitor action plans to implement this adaptation strategy.
- Update the strategy based on the latest climate change forecasts.

■ Reinforcing dialogue between our entities and our respective public authorities

- Participate actively to the national debates devoted to the development of national climate adaptation strategy.



Examples of adaptation

• The small changes to the climate that we have already experienced have forced EDF Energy to re-assess their view of "normal" temperatures. By **integrating the results of climate change prediction models** EDF Energy is now able to more accurately forecast gas and electricity demand over the medium term (3 to 5 year ahead).

• Meltwater from underneath the Mer de Glace, in the Alps near Chamonix, feeds the 40MW "Les Bois" hydropower plant. EDF has **redesigned the sub-glacial water intake**, as accelerated glacier retreat will soon leave the water intake stranded.

• Extended periods of hot weather can affect electricity production. Power plants extracting water from rivers, for cooling or for steam, must work within strict boundaries to ensure stable river water temperatures, so as to comply with regulations. In order to adjust generation output at its power stations beside large rivers in France, and to provide quality information to the authorities, EDF has developed **more efficient hydro-meteorological forecasting systems** which consider water temperatures and river flow rates. EDF is therefore better able to predict the impact of heat waves on its generation capacity and to effectively anticipate periods when river levels are too low, or water temperatures are too high.



Diablo Canyon nuclear power plant, California.



Luis Echávarri
Director-General of the Organisation for Economic Co-operation and Development (OECD) Nuclear Energy Agency (NEA)

The role of nuclear energy in combating climate change

Nuclear power currently provides 14 per cent of global electricity production and reduces global CO₂ emissions by up to 3 billion tonnes per year when compared to electricity generated from coal. In this article, Luis Echávarri, director-general of the OECD Nuclear Energy Agency asserts that increasing nuclear energy to further reduce greenhouse gas emissions (GHG) is possible, but must be accompanied by actions to ensure safety, manage high level waste and prevent proliferation of nuclear material. For nuclear and other capital-intensive low-carbon technologies, the key challenge is economic. Electricity prices must be predictable and a stable, longterm carbon pricing mechanism established.

The need to cut GHG emissions in an effort to limit climate change has become a major driver of energy policy. This includes a shift towards less carbon-intensive solutions for electricity generation. Indeed, many believe that an 'energy revolution' is needed to decarbonise our energy supply, which is heavily reliant on fossil fuels. The consensus among scientists is that at least half of GHG emissions must be cut from 2005 levels by 2050 if the world is to limit the average temperature increase to 2°C above pre-industrial levels.

Electricity supply is one sector in which measures to cut GHG emissions can most easily be introduced and enforced. But decarbonising the power sector over

the next four decades is still an enormous challenge. Existing infrastructure is slow to change and coal-fired plants now under construction may still be in operation in 2050. Meanwhile, demand is rapidly increasing in many developing countries, where large-scale, low-carbon energy sources may not be available or will take a long time to develop.

Nuclear energy already contributes to cutting GHG emissions...

One route to low-carbon electricity is via an expansion of nuclear power. Nuclear power is an established, large-scale energy source with the potential to expand significantly over the next 40 years. In 2009, about 14 per cent of global electricity production, or about 21 per cent of production in OECD countries, was fuelled by nuclear energy. Using nuclear power reduces global CO₂ emissions by up to 3 billion tonnes per year, assuming that this power would otherwise be produced by burning coal. This means that, without nuclear power, OECD countries would emit as much as one-third more CO₂ from their power plants than they do now.

The cumulative emissions of CO₂ from fossil fuels used for electricity production in OECD countries over the period 1971 to 2004 amounted to 218 gigatonnes (Gt), and the cumulative savings from the use of nuclear power were 58 Gt of CO₂ equivalent. In other words,

using nuclear power reduced the cumulative emissions from generating power during that period by over a fifth. Clearly, if the present nuclear capacity were to be phased out, it would make the goal of decarbonising electricity supply an even more challenging and distant prospect.

...and could contribute even more

Nuclear power technology has been developed over more than 50 years, and the latest designs for nuclear power plants incorporate best-practice knowledge. In recent years, a number of governments have also reassessed their approach to nuclear energy and now view it as an important part of their energy strategy. Others, however, continue to believe that nuclear should not be part of their energy supply mix.

Scenarios for future electricity supply prepared by the International Energy Agency (IEA) and the Nuclear Energy Agency (NEA) in the *Nuclear Energy technology Roadmap* (2010), based on a reduction of CO₂ emissions to around half of 2005 levels by 2050, show that nuclear power has a vital role to play, alongside improved energy end-use efficiency, a major expansion of renewables, and carbon capture and storage (CCS) from fossil fuel burning. These scenarios envisage a nuclear capacity of around 1,200 GWe by 2050, compared with 370 Gigawatt electrical (GWe) today – an expansion of over 300 per cent. This would require the completion of around 20 large nuclear plants (of 1.5 GWe each) per year during the 2020s, rising to 25 to 30 plants per year in the 2040s. In its *Nuclear Energy Outlook* (2008), the NEA found that nuclear capacity could reach 1,400 GWe by 2050 under its ‘high’ scenario, through an even stronger expansion in the 2040s.

“The IEA and the NEA projections indicate that nuclear energy could provide around a quarter of global electricity with almost no CO₂ emissions.”

Clearly, these scenarios would require mobilising much greater industrial, human and financial resources than currently exist. Such expansion would take years to achieve, not least because it would require large-scale investment and a major increase in the workforce with the necessary skills and training. However, governments are aware of this issue and are beginning to address it.

The major expansion of nuclear power in the 1970s and 1980s indicates that, given strong policy support, nuclear power can expand rapidly. During the 1980s, nuclear plant completions peaked at over 30 units per year, with an average of 22 units per year over the decade. Although these were smaller than many current designs, the technology was also less well-developed at that time. In addition, relatively few countries were involved in that expansion, and overall global industrial capacity

was significantly smaller. Much of the future expansion of electricity supply will take place in large developing countries. Foremost among them are China and India, both of which are already embarking on ambitious nuclear programmes.

Three facts about nuclear energy

The IEA and the NEA projections indicate that nuclear energy could provide around a quarter of global electricity with almost no CO₂ emissions. However, critics of nuclear power remain concerned about safety, disposal of nuclear waste and the proliferation of nuclear materials and technologies. While there will always be some people opposed to nuclear energy and other complex technologies, we believe that the challenges of nuclear waste and proliferation can be convincingly addressed to the satisfaction of broad majorities in different countries.

It is worth recalling three facts in this context.

Safety: The safety record of nuclear power continues to improve against all the measures used to assess the level of good performance, including worker safety, environmental impacts and frequencies of incidents. Only one incident has occurred in a Western reactor and there were no fatalities or injuries. While the major accident at Chernobyl was an enormous tragedy, the safety record of modern reactors is at the highest level, especially in comparison with other energy producing technologies. This must not lead to complacency, nuclear will always require strict supervision and special safeguards, but its safety performance must be measured according to the same yardstick that is used for other technologies.

Waste: In OECD countries, nuclear waste, including high-level wastes and spent fuel, have been stored for the past 50 years without a single major incident. Most of these wastes have been stored on-site at nuclear power plants in water-filled pools or encapsulated in special containers of vitrified glass in concrete lined holes or appropriately shielded rooms. While a period of cooling is necessary after removing from the reactor, this cannot be a definite solution. That is why several of our member countries are building or are planning to build long-term facilities for final disposal. Again, while all possible safeguards need to be taken, the challenges here are comparable with those for hazardous wastes from other industries and the major impediments are political commitments and public acceptance.

Nuclear proliferation: Proliferation is certainly a challenge to the international community. However, the International Atomic Energy Agency (IAEA) has concluded safeguards agreements with more than 170 countries to date. Comprehensive safeguards agreement and additional protocols reinforcing verifications are concluded with more than 90 countries. Last year, the first international nuclear fuel bank was set up in order to ensure supply and prevent the spreading of enrichment facilities. Nuclear materials are probably the most rigorously controlled and internationally monitored materials under international watch.

The electricity market challenge for low-carbon technologies

In OECD countries, nuclear plants provide large amounts of carbon-free electricity at low and predictable costs for up to 60 years under stringent regulatory oversight that ensures high standards of safety and security. Decision-makers in a majority of our member countries agree with us that the challenges of safety, waste disposal and proliferation can be suitably addressed. What then is holding back a 'nuclear renaissance' to slash GHG emissions?

A major issue is certainly economics. While nuclear plants have attractive average costs calculated over their complete lifetime, they are expensive to build and therefore have high upfront investment costs. According to the new IEA/NEA study *Projected Costs of Generating Electricity: 2010 Edition*, the capital costs of an individual 1,000 Megawatt (MW) usually varies between US\$3 and US\$6 billion at a five per cent real discount rate and between US\$4 and US\$7 billion at a 10 per cent real discount rate. Of course, the precise costs vary significantly, even between OECD countries, due to different reactor designs and different regulatory frameworks as well as due to differences in labour costs and exchange rates.

The combination of high fixed costs during construction and low variable costs during operations is a characteristic that nuclear energy shares with all other low-carbon or carbon-free energies, be they renewable energies for generating electricity, carbon capture and storage or even investments in demand-side management and energy efficiency. Fossil-fuel based power plants, which emit significant amounts of CO₂, instead have comparatively low fixed costs and comparatively high variable costs. This conjunction is not the fruit of chance. High carbon intensity and high variable costs (and comparatively low fixed costs) always come together as they are both due to the same underlying reason: the use of expensive, carbon-intensive and frequently imported fossil fuels such as gas and oil.

In the marketplace for electricity, low-carbon technologies with high fixed costs and low variable costs thus compete with fossil-fuel based technologies with low fixed costs and high variable costs. Concerns about climate change have heightened the overall attractiveness of low-carbon technologies, nuclear among them, from a social point of view. This is increasingly seen in public opinion polls.

However, the economic incentives for private investors have actually shifted to the other direction. The deregulation of electricity markets and the liberalisation of electricity prices have enormously increased the volatility of prices and the uncertainty of investors. Confronted with such unprecedented risks, investors will try to limit their exposure in the case that prices fall and thus opt for technologies with comparatively lower fixed costs. This, however, means more greenhouse gas-emitting, fossil-fuel technologies.

The impact of carbon pricing

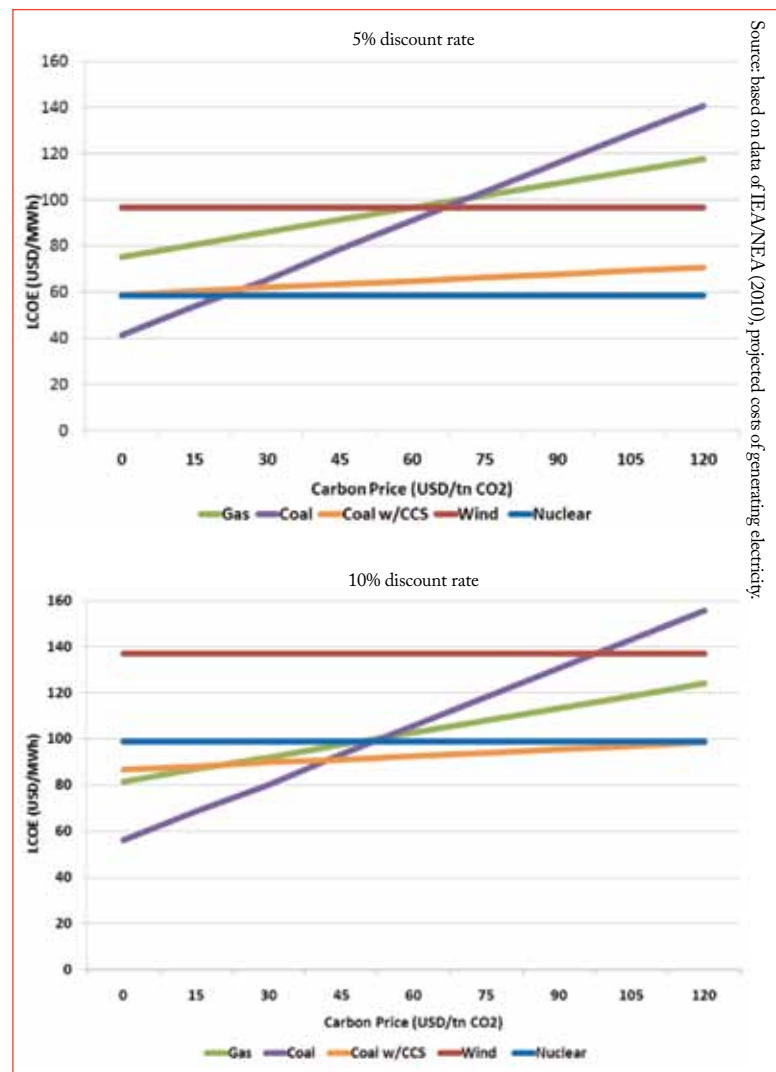
Uncertainty in electricity markets tilts the balance against low-carbon technologies such as nuclear and renewables.

While renewables have to some extent been shielded from this effect through direct subsidies or through subsidised feed-in tariffs, the magnitude of the challenge in terms of GHG emission reductions over the next decades is far too large to be solved by selective subsidisation.

What has supported the drive towards low-carbon technologies in the electricity market is the widely-shared concern about climate change-inducing GHG emissions. Implicitly or explicitly, such concerns translated into an increase of the current or perceived future costs of GHG emissions or, in its simplest form, a price to pay for each tonne of CO₂. The most concrete expression of this trend is so far is the European Emission Trading System (EU ETS), where the price for a tonne of carbon is currently hovering around €15 (slightly less than US\$20).

Of course, such carbon pricing has an impact on the relative competitiveness of nuclear and other low-carbon technologies. The graph below provides an indication of the magnitude of this impact on the basis of joint figures from the IEA/NEA. At a five per cent discount rate, a carbon price of US\$15 makes nuclear the overall least expensive technology for baseload power generation, while a carbon price of US\$60 would make (on-shore) wind

Figure 1: The impact of carbon pricing (levelised average costs at 5% and 10% discount rates).



more competitive than either gas-fired or coal-fired power generation. At a 10 per cent discount rate, which is less favourable for high fixed-cost, low-carbon technologies, a carbon price of roughly US\$50 would be required to make nuclear the absolutely least expensive technology for baseload power generation (excluding so-far unproven coal with carbon capture and storage). Meanwhile, wind power would become competitive with coal only at prices of US\$100 and above. However, even at 10 per cent, nuclear remains most competitive in Asia and America.

While these numbers are only indicative and real capital costs in the energy market are around 8 per cent, there can be no doubt the carbon prices required for establishing competitiveness of low-carbon technologies lie somewhere in between the values mentioned above. Carbon prices play indeed an important role in ensuring the competitiveness of low-carbon electricity generating technologies.

Three steps towards realising the full potential of low-carbon technologies

In order to allow all capital-intensive, low-carbon technologies to realise their full potential in terms of helping provide stable electricity supplies at attractive costs and reducing GHG emissions from power generation, the simple but powerful three-point plan below needs to be followed:

1. Reduce price volatility in electricity markets:

uncertainty about future electricity prices is the major hurdle for capital-intensive low-carbon technologies in their competition with coal- and gas-fired power generation. While the movement towards power market liberalisation in OECD countries is largely irreversible, we must create the conditions for long-term contracts and producer-consumer consortia. This will reduce price risks and minimise the cost of financing, which in return will allow garnering the private and social benefits from the stable variable costs and reduced GHG emissions stemming from technologies such as nuclear and renewable energies.

2. Ensure a reliable long-term signal on carbon prices:

carbon prices are clearly an important driver for the competitiveness and economic viability of low-carbon technologies including nuclear energy, renewables, CCS and even demand-side measures. Most of these investments need to be planned for decades ahead. A clear commitment to a stable price for carbon emissions is the most efficient incentive measure our governments can make to initiate the transition towards a low-carbon economy.

3. Include nuclear energy in any post-Kyoto mechanism for emissions reduction crediting:

Whenever a nuclear power plant is being built it substitutes primarily for coal- and gas-fired plants in the production of baseload power. It thus reduces existing emissions or ensures that future emissions do not rise. For all other low-carbon technologies, such substitution in developing countries generates certified emission reductions (CERs) under the Clean Development Mechanism of the Kyoto Protocol but currently nuclear is not included in this mechanism.

In order to realise the full GHG abatement potential of nuclear energy, it should be included in any successor mechanism under conditions equivalent to those for other technologies.

“Carbon prices play an important role in ensuring the competitiveness of low-carbon electricity generating technologies.”

One of the most influential publications to emphasise that stabilising concentrations of GHGs to a level that would limit temperatures increases to 2-3°C was the Stern Review on *The Economics of Climate Change*. Unsurprisingly, the Stern Review also foresaw a near-doubling of global nuclear capacity by 2050 to 700 GWe as one of the measures to stabilise GHG concentrations. It is one of many forecasts of this nature.

However the modellers and forecasters are not the only ones who are saying it; a simple consideration of the contributors to GHG emissions suggests that any solution to the climate challenge will require a substantial contribution by nuclear energy.

Luis Echávarri is Director-General of the OECD/NEA, a post he has held since 1997. A former Project Manager for three nuclear power plants for Spanish energy company, Westinghouse Electric, he was later made Technical Director of the Spanish Nuclear Safety Council (CSN) and named commissioner in 1987. He is a Fellow of the College of Industrial Engineers in Madrid. He represents the OECD/NEA on the governing board of the International Energy Agency (IEA) and is a member of the International Atomic Energy Agency's International Nuclear Safety Advisory Group.

The NEA is a specialised agency within the OECD, an intergovernmental organisation of industrialised countries, based in France. The NEA works to assist its 28 Member countries in maintaining and developing the scientific, technological and legal bases required for the safe and economical use of nuclear energy for peaceful purposes. It is a forum for sharing information and experience and promoting international co-operation, a centre of excellence where Member countries can pool and maintain their technical expertise, and a vehicle for facilitating policy analyses and developing consensus based on its technical work.

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YES, SUSTAINABILITY IS GOOD BUSINESS FOR PEOPLE, COMPANIES AND THE PLANET.

**Cemig proves it – with 11 years in the Dow Jones
Sustainability World Index.**



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Once again Cemig leads where no Latin America power utility company has gone before - with 11 consecutive years in the Dow Jones Sustainability World Index.

This recognition truly reflects the Cemig Group's commitment to sustainability. And Cemig achieves it with no less than 20 million customers, while operating in all three industry segments - power generation, power transmission and electricity distribution - and having subsidiaries in natural gas, telecoms and energy efficiency. At the same time, it is one of the most financially solid groups in Brazil's power industry sector.

Cemig does business in 20 of Brazil's states, and in Chile, led by its power generation from renewable sources - some 97% of its total generating capacity.

Cemig's shares are held all over the world - by 117,000 stockholders in 44 countries, trading on the stock exchanges of New York, São Paulo and Madrid.

With its growth focused on respect for man and the environment, the Cemig Group has succeeded in making its values prevail - values that have made Cemig recognized and admired in Brazil and worldwide.

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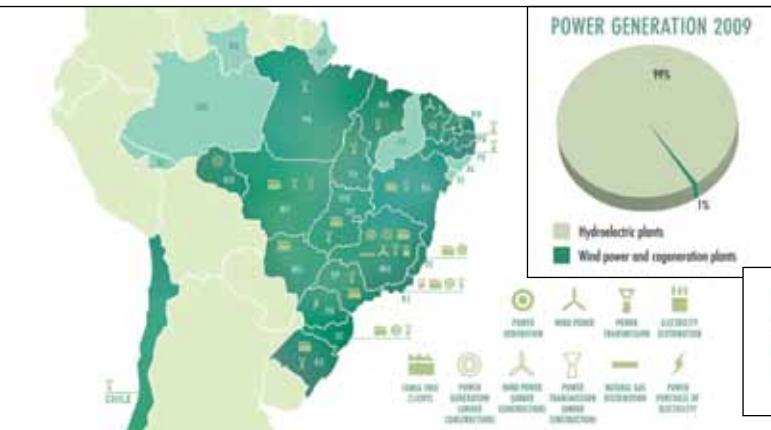
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CEMIG



Clean energy initiatives



Operating for 58 years in the market, Cemig is one of the most solid and important groups in the Brazilian power industry. The parent company of a conglomerate of 62 companies and 10 consortia, Cemig manages a portfolio of power generation, power transmission and electricity distribution assets, in addition to natural gas distribution and data transmission interests.

Cemig is the largest electricity distribution company in Brazil – Market share: 12 per cent, and the third largest power generation and transmission group – Market share: seven per cent and 10 per cent, respectively. The company's long term goal is to attain a 20 per cent market share in each of the power sectors. Cemig's shares are traded on stock exchanges in São Paulo, New York and Madrid.

Cemig is noteworthy for generating its power from renewable sources. In 2009, 100 per cent of the power generated was originated from renewable sources: 99 per cent from hydroelectric plants and one per cent from wind power and cogeneration plants. The company's new projects ensure its growth in terms of power generation utilising renewable sources, especially hydro, wind and solar.

Focus on the climate

In 2009 Cemig obtained the highest score for Climate Strategy from the Dow Jones Sustainability World Index (DJSI World) in the global utilities sector. Cemig undertakes specific actions aimed at the development of Clean Development Mechanism (CDM) projects, energy efficiency programs, the construction of small hydroelectric plants and research and development into renewable energy sources. All the risks and opportunities related to climate change are listed in the Carbon Disclosure Project (CDP).

CDM projects

These encompass power cogeneration projects using waste gases generated in the industrial process at a steel mill that would otherwise be released into the atmosphere.

Other projects identified by Cemig as opportunities that may fit within the CDM include small hydroelectric plants and the utilisation of new energy sources, which are in process of approval and registration.

Energy efficiency

Through its energy efficiency programmes, in 2009 alone, Cemig managed to achieve a reduction in power

consumption of 27,765 MWh/year, which is enough power to supply approximately 19,300 Brazilian residences.

Of special note is the Conviver Project, begun in 2006, which is aimed at providing information to low income consumers about energy efficiency measures. In 2009, the project produced power savings of 3,476 MWh/year through the donation of more efficient equipment, including light bulbs, shower heads and refrigerators. In 2009, the projects run by Efficientia, a company in the Cemig group, made possible power savings of 24,029 MWh/year at the facilities of industrial clients, which corresponds to the annual consumption of approximately 16,700 residences.

Small hydroelectric plants

Through the Minas PCH Program, Cemig has been expanding its power generation system through the construction and installation of small hydroelectric plants in partnership with other companies in the private sector.

Wind power

Cemig was the first Brazilian electric utility to operate a wind farm connected to its electric system, the Morro do Camelinho Wind Farm, in 1994. In 2009 Cemig acquired a 49 per cent equity stake in three wind farms in the northeast region of the country, totaling 99.6 MW. The company has been progressing in this area through the identification of other promising sites for the installation of wind generators.

Solar energy

Cemig has installed photovoltaic systems at many residences in remote regions of the state and solar collectors at low income housing projects to heat water, which is producing a reduction in energy consumption of roughly 30 per cent and greater efficiency in its usage.

Development of new energy sources

Cemig has invested in research and development of new energy sources with projects related to biomass, biodiesel, hydrogen and fuel cells. In 2009, Cemig tested and incorporated into its fleet four automobiles powered by electric energy, giving continuity to this research project.

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Reflective mirrors in a solar farm.



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Alexander Ochs
Director of the Climate and Energy Program,
Worldwatch Institute

Mapping the future:

Why bidding farewell to fossil fuels is in our interests – and how it can be done

Developing efficient, sustainable energy systems based on renewable energy and smart grid technology is not only an environmental necessity: it is a social and economic imperative. We rely on fossil fuels for more than 85 per cent of all energy we use and pay a high price for our dependency, on all fronts. An overhaul of the way we produce, transport, store, and consume energy is underway and an improved energy world is emerging, slowly. Intelligent policies based on concise roadmaps will get us there faster.

People around the world are already suffering from the impacts of climate change. Rising sea levels, melting glaciers, storms, droughts, and floods – these natural processes, artificially intensified by global warming, will affect agriculture, fishing, transportation, and tourism to an ever greater degree. Changing ecosystems and landscapes, biodiversity losses, the surge of tropical diseases, and food and water shortages will lead to economic and welfare losses on an unprecedented scale should climate change remain largely unabated as it is today.

The cost of fossil fuels is unjustifiable

Even if we take climate change, which has been called this century's greatest challenge, off the table for a moment, transitioning our energy systems is a socio-economic imperative. For a host of reasons, our reliance on fossil fuels comes at an unjustifiably high cost to our economies. First, the burning of coal and petroleum

pollutes our air and water. China, for example, estimates that addressing its pollution and pollution-related health problems swallows up to 10 per cent of its total annual GDP. Imagine if the country could put these huge resources into addressing pressing social needs!

Second, fossil-based energy systems force many nations to rely heavily on fuel imports. Despite enormous potential for renewable energy, many countries rely on imports for most of their fuel and electricity supply – some for 90 per cent or more. As a consequence, fuel prices in these countries are higher than elsewhere, creating a heavy economic burden. The volatility of the energy market is another grave problem. An increase of US\$10 in the world crude oil price translates into a 1.5 per cent decrease in GDP in many Pacific small-island states, with dire social consequences.

Third, let us look at energy subsidies. The view still persists that renewables can survive only with the helping hand of governments that fiscally favour them over conventional sources. But the opposite is the case. Almost 20 years after governments decided at the highest level that human interference with the climate system had to be prevented, and despite the heavy burdens that fossil fuel production places on our societies, public subsidies for these fuels are about 12 times those for renewable energy. And this staggering figure does not even include the indirect costs – essentially, additional subsidies – that we all have to shoulder: health problems, pollution control, and the impacts of climate change.

Low-carbon growth is a necessity

There are good reasons to project that those countries that can produce energy cleanly and use it most efficiently will dominate the global economy in this century. Three striking examples of countries that are already committed to accelerating green energy production illustrate the benefits of early action. In Germany, 340,000 jobs have been created in the renewable energy industry alone; South Korea aspires to be Asia's clean technology tiger and projects the value of its energy exports to reach US\$36.2 billion in 2015. Denmark has decoupled economic growth from its energy consumption, expanding its economy by more than a third over the last 20 years while cutting total energy use. In addition, Denmark more than doubled the share of renewables in its energy mix, already at a high level.

There is little evidence that such green ambitions have hurt these three countries, economically or otherwise. In fact, they seem to have weathered the recent economic crisis better than others. Moreover, they are better prepared for the next inevitable surge in fuel prices when the economy takes off again.

For many countries, a low-carbon development path is not a luxury but a necessity. In China – the world's largest producer and consumer of coal, and since last year a net importer – and India, more than 70 per cent of electricity is powered by coal, the dirtiest of all energy sources. Both countries could run out of domestic coal as early as the next 40 years. With regard to oil, China is already dependent on imports for more than half of its supply, and India for almost three-quarters. And even if both countries make their ambitious nuclear plans a reality, the power provided by these new reactors – at relatively high costs – can cover only a small margin of the energy needs of both nations. In India, almost half of households

still lack access to the grid. So what other energy sources remain? What will our future energy system look like?

An unrecognisable renewables future

With the enormous untapped potential of renewable energy and energy efficiency improvements, the world's energy system – from generation to end-use in every sector – could be all but unrecognisable by mid-century. First, renewable energy sources and efficiency will be closely integrated. Our calculations have shown that if renewables and energy efficiency improvements are employed in concert, half of the world's energy needs can be supplied by renewables as early as 20 years from now. By 2050, their integration could lead whole countries to what smaller communities have already achieved today: to be entirely based on renewables, with local pollutants and greenhouse gas (GHG) emissions at or close to zero.

Electricity grids, today powered almost exclusively by large coal, natural gas, nuclear, and hydropower plants, will be increasingly the domain of modular solar, wind,

Our calculations have shown that if renewables and energy efficiency improvements are employed in concert, half of the world's energy needs can be supplied by renewables as early as 20 years from now.

Figure 1: Average annual global growth rate in energy consumption by source, 2004–2009.

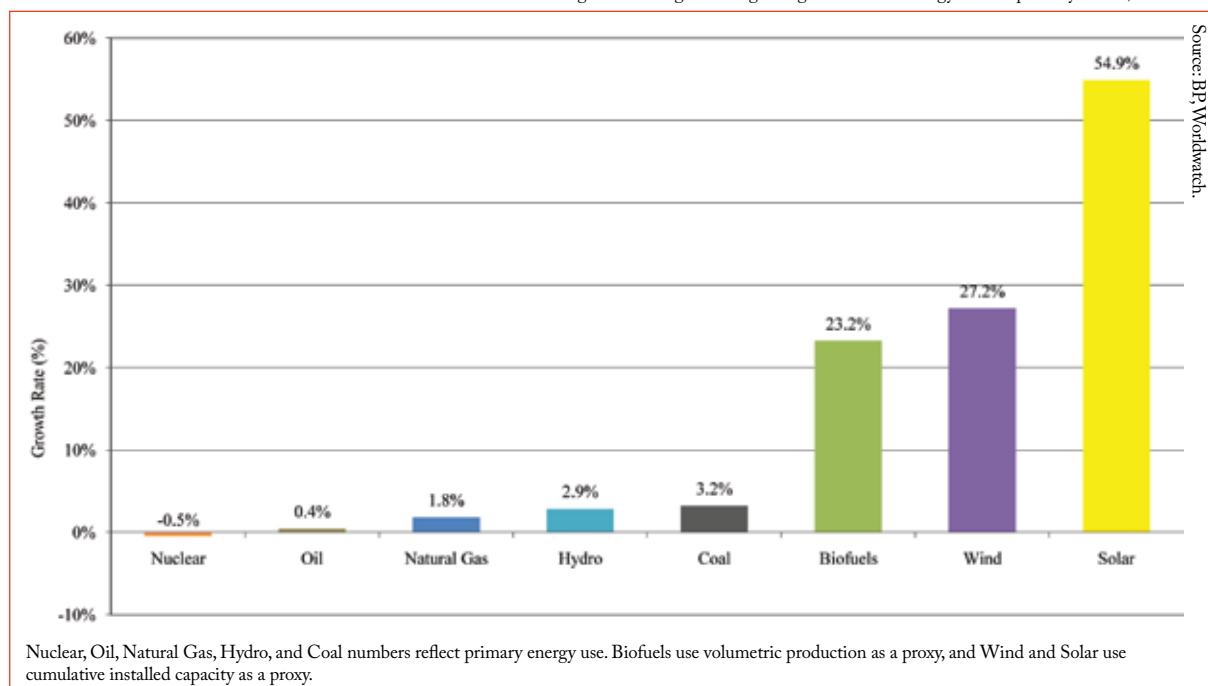
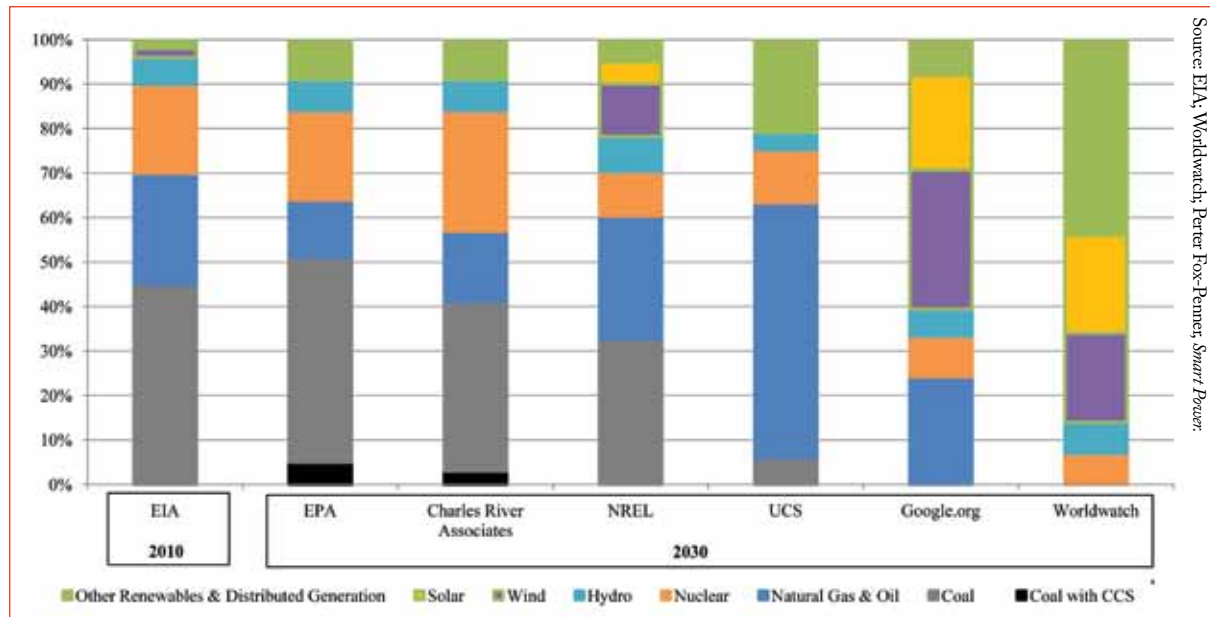


Figure 2: United States 2010 electricity generation mix compared with sample scenarios for 2030.



biomass, small hydro, and other renewable facilities. The 1.5 billion people worldwide currently without access to electricity, often in rural areas far from the existing grid, will be provided with access to power not by extension of the existing grid but through decentralised generation that takes advantage of local resources, whether they are sunlight, wind, water, agricultural and industrial waste, or any combination of the above. Biofuels from algae, grasses, and crop wastes will help lessen the demand for oil.

The sun always shines – somewhere

The intermittent nature of wind and solar energy, a major stumbling block for their integration into large grids, can be mitigated by further expansion, their integration with natural gas and innovative storage technologies, as well as the design of smart grids. Variability decreases dramatically when multiple wind and solar sites in larger regions are aggregated, and this decentralisation of alternative power generation will make production far more predictable.

Natural gas will see an increase in use because it is the least GHG-intensive fossil fuel and can be fed into the grid with much greater flexibility than power from other energy sources, including nuclear. Since coal power plants can be retrofitted relatively easily for natural gas, gas has an important role to play as a natural ally of renewables and a bridge to a 100 per cent renewables world.

It will also be essential to pair energy production with practical storage technologies, including hydropower, which can be tapped easily during production lows. The growth of electric cars will not only lower the demand for oil but also add versatility to the electric grid, as these vehicles can be charged when consumption rates are lowest and then feed power back into the grid when needed. A changing energy generation mix and structure will require significant changes to transmission and distribution networks but these changes will bring their own benefits.

So-called ‘smart grids’ will help consumers save money by informing them about electricity rates in real-time and allowing them to run appliances when rates are lowest. This will benefit utilities by flattening the peaks in energy demand that come at midday. High Temperature Superconducting transmission lines currently in development can carry 10 times the power of a conventional copper cable on a single line and will dramatically lower power losses. All of this will result in utilities needing fewer peak power plants and increase the efficiency of the entire system.

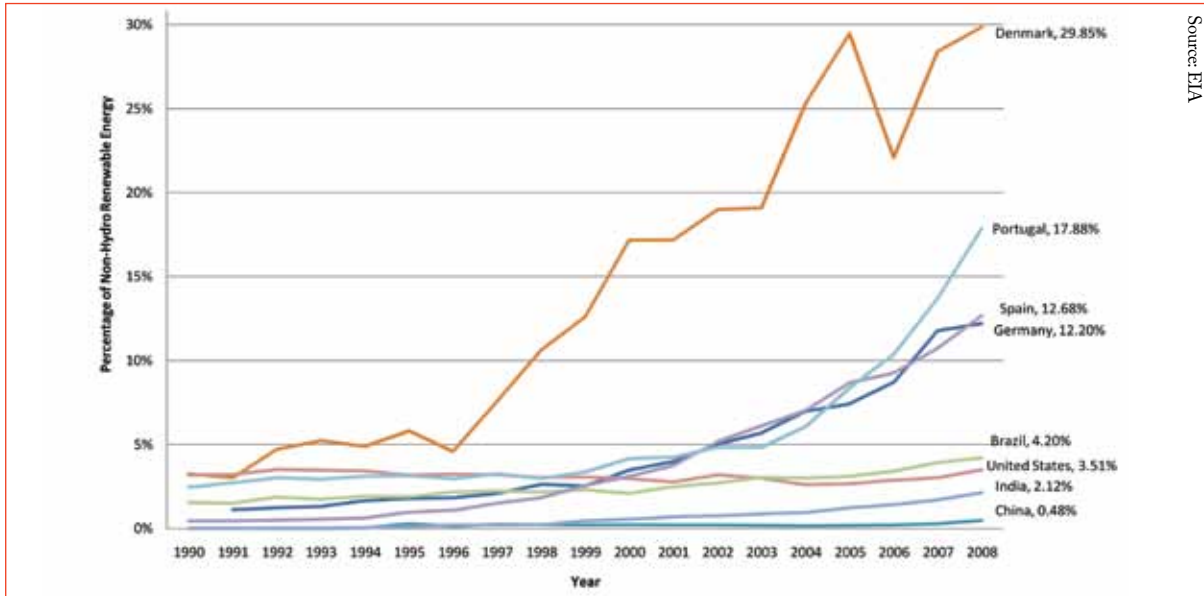
The way in which we use energy will also be transformed with more efficient appliances and the development of inventions that are only now on the horizon. The ‘straddling bus’ that rides over cars to combine the benefits of light rail and bus transit, or roof tiles that change colour to reflect heat in summer and absorb it in winter, for example, could be commercialised, each helping reduce our need for traditional power generation.

A patchwork of policies for a patchwork of technologies

A climate-friendly world based on sustainable energy technologies is technically feasible and socio-economically preferable. But, despite the recent successes of renewables, the mix of technologies that will power our world and reduce our energy needs in the coming decades will not be deployed automatically – at least, not fast enough. These technologies will have to arise out of a patchwork of policies at all political levels, from the local to the global.

Many countries remain unconvinced that moving to a low-carbon economy is in their interest or worth the required upfront investment. Often, necessary information and expertise is lacking. Finding the right way requires roadmaps that assess the solutions that are physically available, economically viable and politically feasible. Detailed energy resource mapping, technological,

Figure 3: Non-hydro renewable energy as a share of total electricity generation.



economic and social assessments, as well as a review of existing policies and practices are important stages to arrive at a comprehensive picture of the environment for investment. The final product of this analysis should be energy policy roadmaps that provide specific steps forward to a low-carbon economy that is in the interest of its citizens. These roadmaps will strengthen government, civil society and industry capacity and help officials coordinate and optimise ongoing low-carbon development activities while increasing investor confidence in new projects.

There are numerous policy options that governments can deploy to increase the competitiveness of sustainable technologies, reduce investment risk, and address vested interests that favour the status quo. Countries at the forefront of low-carbon development around the world have experimented with various policy measures and created a rich toolkit ranging from regulatory approaches to market-based mechanisms. Roadmaps play a crucial role by identifying which of these policies are best for the specific circumstances in a given country or region.

A lack of political will

Worldwide, energy efficiency standards provide incentives for companies to reduce their own carbon emissions and those of their products. 'Passports' for buildings in Germany, for example, encourage infrastructure upgrades and sustainable consumer behaviour. Weatherisation or home insulation programmes help low-income families improve their home's energy efficiency. In 80 countries, provinces, or municipalities – from China to the Dominican Republic to Uganda – feed-in tariffs stimulate renewable power generation by guaranteeing producers of renewable energy a specified price for every megawatt-hour of power fed into the grid. And there is an abundance of market mechanisms at hand to boost clean energy technologies, from the European Emission Trading Scheme initiated in 2005, to the 'bottom tax' that Denmark has used since the early 1990s to create a minimum on fossil fuel prices, which increases over time.

The technologies are available, the policies have been developed and the economics have been proven. We can map our energy future and say goodbye to our unsustainable use of fossil fuels. What we need now is the political will to create an energy system that is in the interest of the people, wherever they live.

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The Worldwatch Institute is an independent research organisation internationally recognised for its accessible, fact-based analysis of critical global issues. The Institute's three main programme areas are: Climate & Energy, Food & Agriculture, and the Green Economy. The Institute's Climate & Energy Program is dedicated to achieving a transformation of the global energy system in order to stabilise the climate and increase energy security. In the programme's 'ReVolt' blog, contributors explore strategies for low-carbon development around the world and report on the latest energy revolutions.

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Solar power: the first phase of the renewable energy scheme.



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Stephen Cirell
Former Director of the Green Cornwall programme for Cornwall Council, UK

The case for local, renewable energy

Cornwall, the most southwesterly county of the UK, is an established hub for green projects and sustainable living. In 2009, it set itself an ambitious target to become 100 per cent energy self-sufficient from renewable sources by 2025.

In a recent lecture in Cornwall, southwest England, Prof John Beddington, the UK government's chief scientific adviser, talked about the 'perfect storm' of water shortages, food production challenges and the need for ever more energy – all in the context of a changing climate.

It may seem to some that the actions that a local authority can take would only have a minimal effect on a problem as vast as climate change, but the potential influence of this middle level in the hierarchy should not be underestimated.

The Renewable Energy Strategy

The council examined its data on energy use and concluded that it consumed around 140,000 megawatt hours (MWh) of energy each year. This was comprised of gas, electricity and oil use, each with a varying carbon footprint effect.

The first conclusion drawn was rather than simply embark on a study of how the council could generate that amount of power, it would be preferable to reduce usage and improve the council's energy efficiency at the same time. This would have a number of beneficial effects, including the reduction of the carbon footprint, saving on energy costs as well as reducing the capital cost of the investment required to achieve self sufficiency in energy production from renewable sources.

However, assuming that savings of up to 20 per cent could be made via these routes, the council would still have to produce over 100,000 MWh a year under this strategy.

The available technologies were then considered. As

a coastal authority in the far southwestern corner of the UK, the authority is blessed with a good climate, featuring high levels of both irradiance and also wind levels. The area is rural and so biomass is also an option. Those three technologies are already commercially proven. Looking to the future, wave, tidal and geothermal offer great promise too.

In 2009, the council set itself a target to be energy self sufficient by 2025. This 16-year period was divided into four quadrants of four years each. This dovetailed with local government elections, also held every four years, meaning a review of progress and a revision of priority level could be undertaken in tandem with any possible change in local council leadership.

In the first quadrant, solar energy would be introduced and in the second, wind energy. Thereafter, heat networks using biomass and other elements would come into play. Slowly but surely, the target would draw closer, project by project.

Developing solar power

The first quadrant, currently underway, is to develop solar energy. The aim is to produce around 30 megawatts (MW) of energy – around a quarter of the council's total energy use. As the feed-in tariff has now been introduced into the UK, it was considered preferable to do this via 5MW projects that could qualify for government financial incentives. Whilst solar park schemes are yet to be procured by local authorities in the UK, experiences across Europe have been good.

The site chosen for the first of six 5MW solar parks is in Newquay, near to the Cornwall Newquay regional airport. This site was considered beneficial because it is in the council's ownership, situated in a sparsely-populated area, close to the airport and has a 33 KVA grid connection available. The airport could be a potential

energy user and the council has also planned an industrial park in the area, though development has not yet started.

The pre-planning work on this site has now commenced and no objections from local residents were raised during a consultation process in the late summer of 2010. There are some issues to do with the operation of airports in the vicinity of photovoltaic (PV) sites that need to be addressed but these are seen as resolvable during the planning process.

The business case for a solar park is a key element, as this has gone some way to convincing skeptics that it is an appropriate scheme for the council to undertake. The payback on a capital cost around UK£10million is likely to be less than 10 years and this will leave substantial surpluses to be reinvested in other green projects featured in the council's Green Cornwall programme. The council is likely to raise the funds from its own sources and so it was not necessary to consider other financing options.

The benefits to Cornwall

The benefits of a public energy scheme far outweigh those available from a purely private investment:

- **Energy security** – Energy supply is a priority in Cornwall given its westerly location in the UK. It will become increasingly important as energy prices and availability fluctuate;
- **Cost savings** – Savings from increased energy efficiency and from no longer purchasing grid energy. Cost savings will increase as prices are predicted to rise in the future.
- **Economic development** – The creation of new, local 'green collar' jobs as renewable energy projects are constructed in Cornwall.
- **Council as a community leader** – The bold 2025 pledge enables the council to take on a sustainability leadership role under the green agenda.
- **Income generation** – Renewable energy generation will create a new income stream for the council.

This means that the benefits of the council undertaking this project are spread across the community and wider area, particularly in relation to the local supply chain. It is also a way for the council to deliver on wider policy aims, including economic development, carbon emission reductions and energy efficiency.

Following commissioning and construction of this first project at Newquay in 2011, the council will review its solar plans before embarking on the remaining projects in the series. If all are procured, it will have secured a full 25 per cent of its energy needs from renewable sources – a significant move towards meeting its target of energy self sufficiency.

'Invest to save' – the future benefits of renewables

Both national and local government are keen to invest in the future, particularly in a recession. The council is able to demonstrate, via the income stream for major renewable energy projects, that loans can be serviced and that assets created will have future value. Over and above this, is the added benefit that some of the higher

income-generating projects will create a surplus which can be reinvested in other green schemes. In this way, the solar programme can be the catalyst for more extensive renewable energy projects in Cornwall and this situation may well be replicated around the country.

The government's targets, set down in the Climate Change Act 2008 will only be reached with radical action. Whilst the focus to date has been on central government and the development of its climate change policy, this now needs to shift towards local government, where the process of delivery can begin.

Both national and local government are keen to invest in the future.

Local government is pivotal to action at every level in the chain. It can act as community leader, with influence on other parts of the public sector, such as the health service or education, and private sector, via Local Strategic Partnerships. It can influence its own service provision and the running of its estate, land and buildings and can also help community groups devise and implement small-scale renewable energy initiatives using community buildings.

The wider social and community-building benefits add to the pure economic benefits of cost savings on energy and new income generated from council-owned renewable energy sources.

The stage is now set: many local authorities have observed the trail blazed by Cornwall Council and have decided to follow suit in developing a comprehensive renewable energy strategy. The solar park will open in autumn 2011 and is just about to start the tendering process. The wide-ranging benefits of local, clean energy generation are being seen and should be seized on a local council level nationwide.

Stephen Cirell is an expert in local government law and climate change. In August 2009, he joined Cornwall Council on secondment as Director of their Green Cornwall programme to lead on all climate change issues. He is now an independent consultant on climate change. He has written widely on different aspects of climate change, including waste management, legal powers to generate electricity and eco towns. He has worked on the Local Government Information Unit's Carbon Trading Councils project, which is a dry run for carbon trading as required by the Climate Change Act 2008.

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Daniel Kreeger
Co-founder and Executive Director of the
Association of Climate Change Officers

Modernising the workforce:

understanding the role of human capital in responding to climate change

A transformation in how the workforce operates and, more specifically, in how energy and the environment factor into the responsibilities of each employee, is the cornerstone to successfully addressing climate change, says Daniel Kreeger, co-founder of the Association of Climate Change Officers.

Over the past few years in the US, organisations in industry, government, academia and the non-profit community have made significant commitments to cutting their carbon emissions and implementing wide-ranging climate strategies. Over a thousand American mayors have signed the US Conference of Mayors Climate Agreement and nearly half of American states and Canadian provinces are signatories to regional climate pacts. In the private sector, hundreds of multinational corporations have made public commitments to reduce their carbon footprint.

Many more climate-related commitments are being made worldwide. While these commitments reflect an extraordinarily encouraging groundswell of climate responders, they also lead to a great challenge: how do we modernise a workforce and our governance systems that are accustomed to operating, functioning and rationalising based on a concept not too distant from the 200-year-old American doctrine, Manifest Destiny?

A 21st century workforce

Climate change presents a set of risks and opportunities to an organisation's operations that are unprecedented in scope, complexity and scale. The modern workforce will evolve to tackle these challenges, which include:

- Incorporating energy and environmental impact analysis into all job descriptions;
- Developing green incentive structures for employees whose innovations result in climate-related risk mitigation or cost/emissions reductions;
- Establishing internal communications campaigns and updating standard operating procedures;
- Developing new organisational structures to accommodate change in management and operations,

and in particular, to establish enterprise governance on climate-related strategies.

The greatest challenge in achieving these goals relates to how we integrate environmental attributes into the basic functions of all jobs and governance systems. Essentially, the guiding principle in the modern workforce is not 'green jobs' for some, but 'job greening' for all. Principles that will need to be reflected in the job greening process include:

- Natural resources are not limitless;
- All actions have immediate, potentially wide-ranging and long-term implications on ecosystems;
- Energy and environmental considerations play a fundamental role in all operations and professions and must be considered by all members of the workforce, regardless of role or seniority;
- Environmental impacts can be assigned tangible value resulting from the lifecycle assessment of operations and products and the recognised value of ecosystems, thus enabling environmental impacts to become a prime component of the business case for operational strategies.

Is all this necessary?

Industry, academia and government are decades overdue for a complete overhaul in how business is conducted, professionals are educated and trained, management is structured and how energy and environmental considerations are factored into the business bottom line. Our ability to redesign the workforce is hinged upon executives and senior officials understanding the role of human capital and its importance in their organisational missions. While those executives are focused on green jobs, a shift in mindset to job greening is the real chasm that needs to be crossed.

Recent studies indicate that hundreds of billions of dollars is squandered within the US workforce alone due to 'disengaged employees'. Organisations with an engaged workforce have 2.6 times the earnings per share growth rate over comparable organisations in the same industry with a less-engaged workforce. Added to this, research has found that college graduates are increasingly likely to

select an employer that prioritises operational greening over one that does not.

Professionals will modify their behaviour to mitigate impacts and seize opportunities if they understand the significance of energy and environmental considerations in their respective roles. Savvy organisations are already moving in this direction, and it starts with the basics:

- Numerous companies have created and support employee 'green teams', whose members monitor the activities of their peers and seek to shape behaviour.
- Companies such as Walmart have launched personal sustainability programmes and have seen extraordinary innovation in the workplace develop as a result.
- Other companies, such as Lockheed Martin, General Electric and Toyota, have conducted 'treasure hunts' to identify money-saving opportunities related to waste, energy and other environmental considerations at their facilities and saved millions of dollars.

These examples demonstrate the importance of leveraging the combination of green and clean energy professionals in overhauling and modernising industry operations. Imagine, though, where industry would be if the architects and designers of these operations had already been educated and trained to take these sorts of factors into consideration when the operations and facilities were launched?

Education ... Education ... Education

A modern workforce that accounts for energy and environmental implications as a fundamental principle of operations does not come at the snap of the fingers, despite the evident rewards. Education and training are necessary to change behaviour and provide the capacity to effectively tackle the challenges and opportunities ahead.

A growing number of professions are evolving in response to climate change challenges and opportunities. From clean energy procurement to supply chain efficiencies, investor/stakeholder relations to legal/liability considerations, facilities and operations management to product design, an explosion in skill sets is taking place.

So how do we embed these skills and principles into all areas of an organisation? Some crucial steps toward modernising the workforce are illustrated below:

- **For executives/senior officials:** Workshops to bring these insights to senior executives and officials across all sectors will be critical to secure senior level support and resources allocated to overhauling the workforce.
- **For human resources administrators:** HR professionals are often left out of discussions related to climate change but play significant roles in effecting change in the workforce. Training priorities in HR will include how to incorporate climate change responsibilities into job descriptions, identify candidates better positioned to meet these challenges, and how to develop internal communications campaigns about sustainability.
- **For academic institutions:** These institutions will need to develop new curriculum across all of their programmes, including, at the very least, business schools, engineering and environmental programmes, public affairs, law schools, medical schools, research institutions and IT programmes.

Next steps

How do we convince society that the same actions that led to great comforts and new pursuits now threaten the very fabric of humanity and ecosystems on Earth? Ultimately, this means that the challenge in responding to climate change is one that must be met by the force of extraordinary human capital. So, how do we rewrite the human resources handbook?

“Education and training are necessary to change behaviour and provide the capacity to effectively tackle the challenges and opportunities ahead.”

A roadmap to educating an entire workforce and government, and functionally changing culture, is necessary to transform our operating practices. If our practices of the past century are point A, then charting a course for point B, a society whose operating and business practices are fully sustainable is our mission.

Getting from A to B requires researching and developing new technologies, innovating new business processes, overhauling waste streams, and accounting for lifecycles of operations and products. These actions, amongst others, reflect a new way of doing business. From a human resources perspective, one might consider this job greening, and the modernisation of the world's workforce.

Daniel Kreeger is co-founder and Executive Director of the Association of Climate Change Officers. While leading the association he has focused on educating industry and government on the importance of developing sound organisational structures and change management programmes, and establishing incentives to encourage innovation and successful response to climate change considerations.

The Association of Climate Change Officers is a non-profit, professional development organisation founded in 2008. It aims to advance the knowledge and skills of those responsible for leading climate change strategies in both the public and private sphere. The Association of Climate Change Officers provides a flexible forum for collaboration between climate change officers and the exchange of best practice, industry standards and new thinking around climate change strategy development. It educates industry and government on the importance of employing qualified professionals, developing sound frameworks for sustainability and establishing incentives to encourage innovation in greening jobs and operations across whole organisations.

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Building energy consumption can be reduced through ultra-efficient new build technologies, such as these energy generating wind turbines in a car park.



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Dr Paul Waide, Director of Navigant Consulting's European Energy Practice, and Vince Reardon, Communications Consultant for the Renewable Energy & Energy Efficiency Partnership (REEEP).

Energy efficiency in buildings: realpolitik for mitigation

Buildings are responsible for around 40 per cent of world energy use meaning the sector has huge potential for cutting its carbon output. Constructing new ultra-efficient, zero energy buildings is only half the story. What is needed is a rapid increase in the rates of retrofitting and renovating for existing homes and workplaces. Such a task requires robust policy that incentivises both owners and construction companies to get the world's building stock energy efficient and green.

A supply-side view masks an opportunity

Climate negotiations have often followed a supply-side logic that insists that mitigation objectives will only be met if there is:

- a commitment to national reduction targets or, if that can't be agreed, then;
- a set price signal for carbon or, failing that;
- agreed sector intensity targets for industry

But this UNFCCC agreed practice of attributing emissions to the direct point of production (power plants, smokestacks, automobile tail pipes) effectively masks a fundamental issue: that emitters and their emissions exist as a response to a real demand for products and services.

Buildings make up 40 per cent of emissions

The energy services consumed in buildings – heating, cooling, ventilation, lighting, water heating, cooking, entertainment, computing, etc. – account for about 40 per cent of world energy demand and energy-related CO₂ emissions. In Europe and the US, the figure sits at world average. In China, buildings are estimated to account for 30 per cent of energy consumption. Some 80 per cent of this energy is incurred during the operating lifetime of buildings. Worldwide carbon emissions resulting from buildings are significantly more than those from the transportation sector.

The buildings sector is also one of the world's largest industries and biggest employers. Construction accounts for about 10 per cent of the world's gross domestic product and is estimated to employ 180 million people worldwide.

All the major studies investigating cost-abatement potential conclude that there is vast potential for savings in the built environment, with a payback. For example, the IPCC 4th assessment report of 2007, which conducted a synthesis of international abatement potential studies, found that by 2020, about 4 Gigatonne (Gt) of CO₂ could be abated annually in the global building stock at negative cost to society – in other words, at a theoretical profit.

Worldwide carbon emissions resulting from buildings are significantly more than those from the transportation sector.

Technically, it is possible today to reduce building energy consumption by 70-80 per cent or more through a mixture of ultra-efficient new build and deep energy-efficient retrofits of the existing building stock.

On the new build front, a significant number of NZEBs (Nearly Zero Energy Buildings) serving diverse functions have already been built around the world in a variety of locations and climates – including some 50 examples in the Cancun area, financed with the help of the Canadian government. These have helped demonstrate the technical viability of such designs. Though there are still issues to be resolved regarding performance limits for some specific environments, the technical solutions for buildings that consume virtually no energy – or are even net energy producers – are available today.

Retrofitting the existing building stock is the parallel challenge. This is particularly true for developed countries. In the US, two-thirds of existing apartment buildings were built before 1980. In Europe, roughly half of all buildings were constructed before the first energy crisis in 1973 and new buildings are only added at a rate of about one per cent of the total stock each year. This means it will not be possible to meet the EU's 2050 CO₂ targets unless the existing building stock is renovated to very high efficiency levels.

The first-line retrofit measures, such as improved insulation and better windows, are relatively simple and each one alone can have significant impact in the short term, which is tempting for many. However, according to the Energy Efficiency in Buildings project of the WBCSD, in order to attain a truly transformative 72 per cent energy reduction, a comprehensive set of retrofit measures will be required, including everything from improved envelope to more efficient lighting, new heating systems, and low-energy appliances. This sort of 'deep renovation' is the real key to achieving a step-change in retrofits.

Barriers to energy efficient buildings are common

Energy efficient solutions in buildings clearly make sense at the societal level, but they often run into obstacles on the ground. Most are rooted in the fact that energy efficiency isn't generally visible to the end user – unless it hits his or her own wallet.

The biggest issue is the one of split incentives, which arise wherever the investor paying for the renovations is not the one who will benefit from the energy savings. The best-known of these is the landlord-tenant barrier, where a landlord owns a property and pays for renovations, but the tenant is the one to benefit from the lower energy bills. This issue also extends across 'generations' of building owners. If someone is unsure how long they will actually own their property, they will tend to heavily discount the value of future savings from reduced energy bills, making energy efficiency refurbishment a de facto short-term investment decision.

Split incentives can apply to new buildings as well. Many businesses split infrastructure investment management from ongoing operation and maintenance. Developers sell the constructed properties on to others. This means that those responsible for the actual construction often aim to build at the lowest absolute cost, without factoring in the energy and maintenance costs over the life of the building.

Other barriers are rooted in a simple lack of awareness. For example, the new building supply chain is highly fragmented. Many key actors, starting with architects and contractors, and moving on to the many procurers of building materials and components as well as their suppliers, are unaware of the potential offered by more energy efficient solutions.

The IPCC found that by 2020, about 4Gt of CO₂ could be abated annually in the global building stock at negative cost to society – in other words, at a theoretical profit.

Most of the barriers to energy efficient buildings will not be affected by CO₂ pricing, which will serve to send a clear signal to polluters, to increase energy costs and exert a downward pressure on energy demand in buildings, but it will not promote a transformation in the buildings sector.

There are clear ways to tackle the barriers

A multi-faceted approach is now needed with robust policy measures that together create strong incentives to ensure new buildings are constructed to net zero energy standards and to create incentives that spur the low-energy retrofit of existing buildings. Promising signs of this are already emerging on many fronts.

Building codes are undergoing revision around the world. The 2010 recast of the EU's Energy Performance in Buildings Directive (EPBD) means that by the end of 2020, all EU Member States must adopt building energy performance codes that apply to new buildings and all major retrofits, that all new public sector buildings must be NZEBs by 2019 and any new building must reach the NZEB standard by 2021.

Across the globe, by the end of 2009 some 40 countries had already adopted mandatory building codes to encourage energy efficiency, including nations from across the climate negotiating spectrum. China, Japan, Jordan, Kazakhstan, Kuwait, Tunisia and Turkey are among those with mandatory measures, and a further 21 countries including the US and Canada, South Africa and Russia have either mixed or voluntary building code energy standards.

Property renovation financing products should be set up so they incentivise deep renovations rather than short-term, cherry-picking measures.

Work remains to be done in addressing split incentives, but the outlines of a solution are clear. The 'pay as you save' principle needs to be incorporated into financing and contractual vehicles that can cope with changes of ownership and still be beneficial for all affected parties: the financiers, the property owners, the mortgage providers and the contractors who would do the energy efficiency renovations. Property renovation financing products should be set up so they incentivise deep renovations rather than short-term, cherry-picking measures. The latter might be the most cost-effective at first, but they fall short of the deep renovation needed.

In practice, a ramp-up of renovation rates also implies a shot in the arm to the construction sector worldwide, with the associated increases in employment, skills and investment. Here, the need for awareness-raising among all parts of the construction supply chain is critical. Grass-roots efforts are already emerging. For example, REEEP is collaborating closely with Himin Solar and the Berne University of Applied Sciences to initiate a training programme in China aimed at sensitising architects and building professionals to the possibilities of energy efficient technologies.

The transformation of the building sector is a mammoth task but a thoughtful and detailed roadmap for the sector's change is already part of the WBCSD Energy Efficiency in Buildings project publication, *Transforming the Market*. This document takes a comprehensive look at the barriers to buildings energy efficiency and lays out specific actions for government authorities, for developers, investors, utilities, suppliers, architects, contractors and building occupiers.

Through this transformation, energy efficiency in buildings can yield a triple win:

- lowered emissions;
- economic development including employment benefits;
- enhanced energy security.

Let's act where we already agree – and put the details first

The buildings energy efficiency challenge is clear and definable, and addressing it will bring tangible benefits. Countries across the negotiating spectrum are already taking action independently. Using the global climate negotiations as a forum to develop a framework that assists countries in identifying all the building energy efficiency triple-win solutions, developing the enabling policy framework and supporting the massive capacity building effort required to implement it would be a constructive step.

Turning the order of dialogue about the framework on its head and going for the details first could make a global climate accord much more tractable. By delivering targeted efficiency measures in buildings without any economic disruption, the willingness to make deeper commitments in other areas might grow.

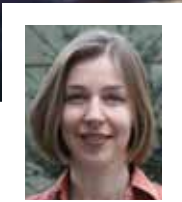
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Vince Reardon is a Communications Consultant to REEEP, where he is responsible for outreach activities. He has also worked for the Asian Development Bank and other institutional clients in the renewable energy and energy efficiency sectors.

REEEP is an international partnership with the mission of widening energy access to the poor and reducing GHG emissions through the development of renewable energy and energy efficient technologies. In five years the organisation has offered funding to 132 targeted policy and finance projects in 56 countries, with an emphasis on the major emerging markets.

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The 'sleeping giant' of renewable energy is waking up.



Elena Merle-Béral
Energy Analyst, International Energy Agency (IEA)

Dormant renewables in Russia

Time to wake up

A global low-carbon revolution is needed if we are to keep global warming beneath the considered safe limit of two degrees. Russia, as the world's largest producer and exporter of fossil fuels, can and must be part of this revolution. It has huge renewable energy resources that, unlike its fossil fuel reserves, have hardly been developed. However, there are signs that the sleeping giant of renewable energy is waking up. Elena Merle-Béral from the IEA discusses the prospects of developing renewable energy in Russia.

Global low-carbon revolution

The IEA publication, World Energy Outlook 2009 (WEO-2009) demonstrates that the world needs a rapid and comprehensive transformation in the way we produce, transport and use energy in order to limit the rise in global temperatures. WEO-2009 Reference Scenario provides a baseline picture of how global energy markets would evolve if governments made no changes to their existing policies and measures. In contrast, the 450 Scenario shows a world in which collective policy action is taken to limit the concentration of greenhouse gases in the atmosphere to 450 parts per million of CO₂ equivalent (ppm CO₂-eq), which corresponds to a global temperature increase of two degrees celsius. The 450 Scenario depicts in detail where and how the abatement should take place.

Figure 1 shows the kind of technology efforts needed to achieve the 450 Scenario in Russia. It demonstrates that renewable energy is the second most significant element in achieving CO₂ emissions cuts after energy efficiency, particularly up to 2020. By 2030, renewables would account for one third of the total Russian abatement potential, or 190 million tonnes of CO₂ (MtCO₂). This would require significant additional investments compared to the Reference Scenario, but would also result in considerable economic, environmental and social benefits for Russia.

Russia today

Russia's energy mix is dominated by fossil fuels. Natural gas accounts for over half of total primary energy supply

(TPES), and coal and oil combined account for another 38 per cent. Renewable energy and energy from waste account for only three per cent of Russian TPES (Figure 2).

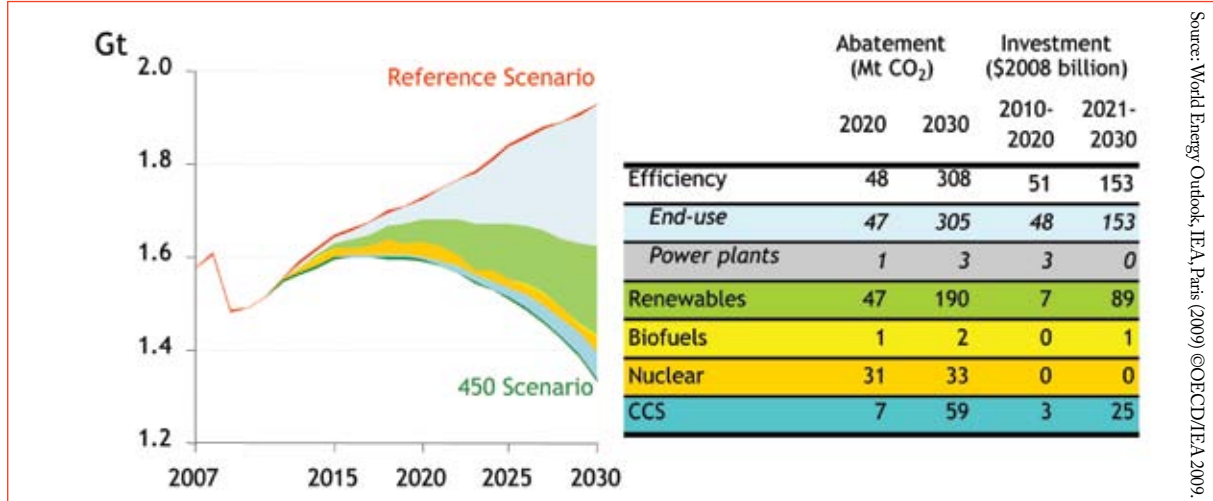
However, the share of renewable energy in electricity generation was around 16 per cent in 2008. This is rather high compared to some IEA countries such as Poland or the Czech Republic that do not have significant hydroenergy resources. However, in many other IEA countries, including Norway, Austria and Canada renewable energy accounts for over 60 per cent of total electricity production (Figure 3).

Figures 2 and 3 demonstrate that only two renewable energy sources – large hydro and biomass – noticeably contribute to Russia's total energy balance and electricity generation. The share of other sources – wind, solar, geothermal or tide – is insignificant. This is despite the very rich and diverse renewable energy resources available in Russia. Therefore, Russia could be called a renewable energy 'sleeping giant' that needs to wake up and tap into its huge potential.

In the early 2000s, Russian experts estimated that the economic potential (i.e., commercial viable use) of renewable energy in Russia might correspond to about 30 per cent of the country's TPES. Bezrukikh et al calculated the economic potential of Russia's renewables to be more than 189 million tonnes of oil equivalent (MTOE) per year, or 270 million tonnes of coal equivalent. Russia's TPES was 623 MTOE in 2002 and 687 MTOE in 2008. Although the accuracy of these estimates can be debated, it is clear that Russia has significant and various renewable energy resources due to its geological, climate and terrain diversity (IEA, 2003).

Russia has a scientific and technical base for developing renewable energy. Research and development on renewables started in the Soviet Union in the 1920s. Since then, Russia and other former Soviet states such as Ukraine have developed nearly all currently known renewable energy technologies. Their cost is lower than that of western equivalents, although the quality and reliability is typically lower, too. Following the decline in industrial production in the 1990s, many idle plants and

Figure 1: Russia energy-related CO₂ emissions abatement, relative to the Reference Scenario.



Source: World Energy Outlook, IEA, Paris (2009) © OECD/IEA 2009.

factories, especially in the military complex, converted to production of more modern technologies, including renewable energy systems. However, without ready markets, a commercial industry has been slow to develop.

Potential markets

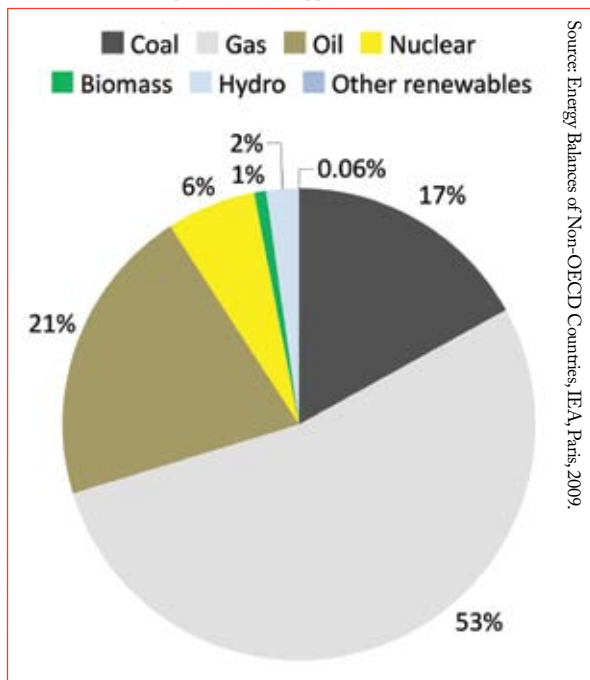
There are many applications where renewable energy sources may have a competitive advantage over conventional energy sources, for example, in both large-scale and distributed (decentralised) electricity generation, as well as heating. There will be more such applications in future when domestic gas prices increase and the cost of renewable energy technologies fall further.

Although Russia as a nation is an energy exporter, most Russian regions 'import' fossil fuels from the few energy-rich regions, primarily from Western Siberia. Given the long distances between regions, transportation costs

dramatically increase the end cost of fuel. Indeed, some remote territories such as Kamchatka, Tyva and Altai spend more than half of their budgets on fuel. Moreover, disruptions to fuel supplies are common. Most regions have locally-available renewable energy resources that can be exploited to improve energy security and reduce energy supply cost. Geothermal plants are viable in Kamchatka, the Kuril Islands and the North Caucasus. Large-scale use of biomass for energy purposes is cost-effective in the north-western part of Russia, where the pulp and paper industry is well-developed. Wind projects could eventually become commercially attractive in coastal areas of the Russian Far East, in the steppes along the Volga River and in the North Caucasus. Small-scale hydro could be developed in many regions with favourable conditions.

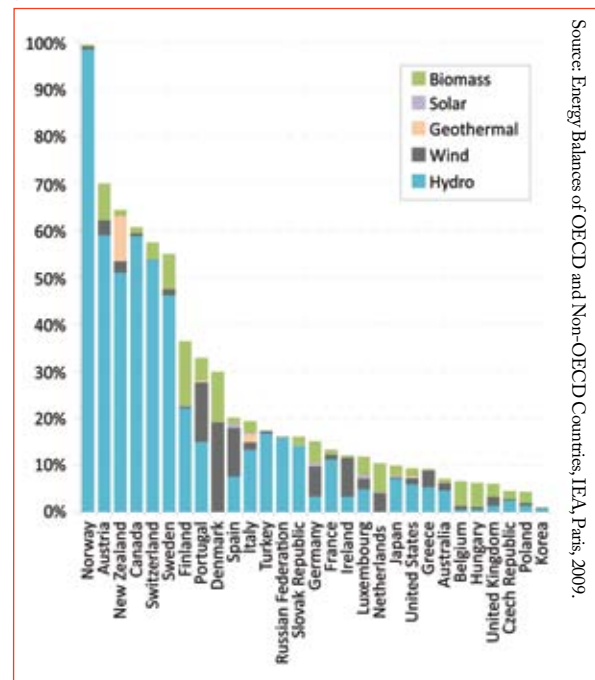
There is a huge potential market for off-grid renewable energy systems. About 10 million Russians are not

Figure 2: Russia's total primary energy supply, 2008.



Source: Energy Balances of Non-OECD Countries, IEA, Paris, 2009.

Figure 3: Electricity generation from renewable energy as a percentage of all generation in Russia and IEA member countries, 2008.



Source: Energy Balances of OECD and Non-OECD Countries, IEA, Paris, 2009.

connected to the electricity grid and are served by stand-alone generation systems using diesel fuel or gasoline. The remote Northern and Far Eastern regions obtain their fuel by rail or road and sometimes even by helicopter. The cost of transporting these fuels is not entirely borne by the end users of these systems: removing energy subsidies here would make renewable energy a viable alternative.

Another potential market for renewable technologies could be Russian dachas or country houses. Nearly all families in Russia have a country house or a small plot of land where they grow vegetables and fruit. Many of these dachas are not connected to an electricity grid and many others have unreliable power supply.

Use of renewables for heating is particularly attractive in Russia given its cold climate. Direct use of geothermal energy for space heating and hot water production is commercially viable in Kamchatka and other regions with geothermal resources. Conversion of coal- or oil-fired district heating boilers to burn biomass (especially wood waste) is another cost-effective application, particularly in cases where consumers face unsubsidised heavy fuel oil and coal prices. Small and medium-sized boilers have already been converted to biomass use in Belarus, Estonia, Latvia, Lithuania and some Russian regions.

Renewable energy can contribute to regional economic development, create local jobs, and reduce both air pollution and greenhouse gas emissions. Increasing domestic use of renewables would also mean more oil and gas available for export, given that oil and gas sectors will face significant investment challenges to meet both domestic and export demand.

Is the giant waking up?

Why has the deployment of modern renewable energy technologies been so slow in Russia, despite huge resources, existing potential markets and the numerous benefits? Part of the reason is down to the widespread belief that only countries dependent on energy imports have to develop renewable energy, while Russia, rich in fossil fuels, does not need this expensive toy. This misguided mentality has translated into the lack of a renewable energy policy and support mechanisms – something that has only changed very recently.

The current structure of Russia's energy market and domestic energy prices are other major barriers for increased use of renewables. As Figure 2 has demonstrated, Russia's energy mix is dominated by natural gas. Domestic gas prices, as well as electricity and heat tariffs are state-controlled and have often been kept below cost. Cross-subsidies are still widely spread. When the cost of using renewable energy is compared with the distorted, subsidised prices of conventional energy, it is not surprising that renewables are not competitive. Other barriers include: low awareness about renewable technologies and their advantages; high capital cost, and limited access to financing.

Nevertheless, Russia is making considerable progress in most of these areas. Renewable energy has been raised to the highest national policy-making level. Amendments to the electricity law, adopted at the end of 2007, introduced the concept of renewable energy sources and outlined key measures for their development. This law was followed by

a number of regulations. In January 2009, Prime Minister Putin signed an executive decree which sets specific targets for expanding the share of renewable energy (without large hydro) in electricity generation from less than one per cent in 2008 to 1.5 per cent in 2010, 2.5 per cent in 2015, and 4.5 per cent by 2020.

The Russian Ministry of Energy is tasked with developing support measures, including price premiums and purchase obligations for electricity produced from renewables; improving statistical reporting, and raising public awareness. Development and implementation of effective support measures will be key in meeting the declared targets.

Encouragingly, Russia is moving toward market-based prices. Domestic gas prices are gradually rising, which opens new opportunities for renewables. The ambitious programme of electricity sector reform reflects recognition among policymakers that it is vital to create markets operating in response to genuine price signals. How this programme will be implemented is critical. Improving the overall investment climate by continuing the economic, financial, legal, regulatory and fiscal reforms is vital for renewables and the energy sector as a whole.

Russia can be an active player in the global low-carbon energy revolution if it extends the reforms of its energy sector, eliminates subsidies for conventional energy sources, and speeds up the development and implementation of effective support framework for renewable energy. At the same time, government actions are needed to boost energy efficiency, which can be the largest contributor to CO₂ emissions abatement in Russia. These actions are required urgently: for every year that passes, the window for action on emissions over a given period becomes narrower and the costs of transforming the energy sector increase. Put simply, saving the planet cannot wait.

The views expressed in this article are those of the author and do not necessarily reflect the views or policy of the International Energy Agency (IEA) Secretariat or of its individual member countries.

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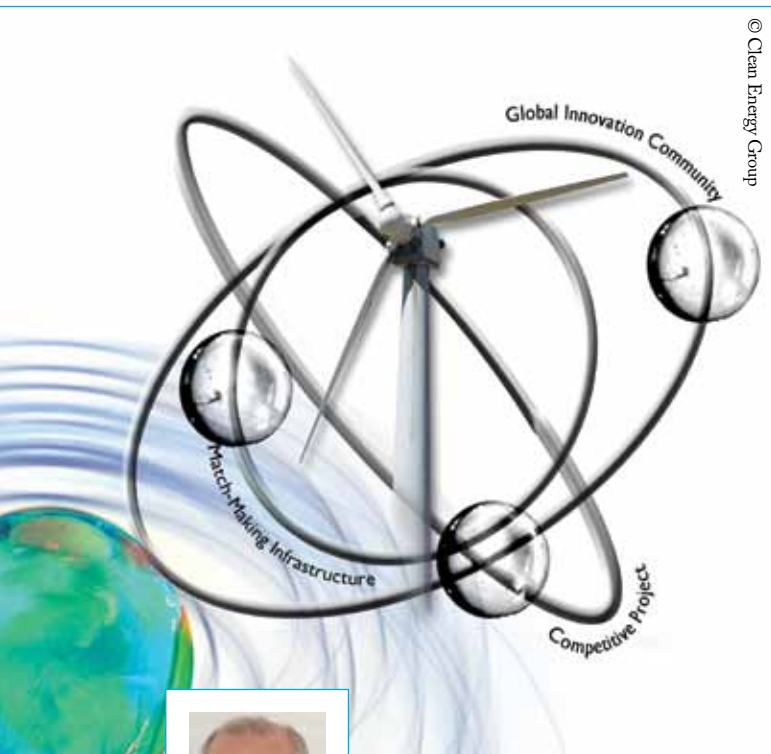
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Technology and Business

Clean Energy Group proposes creating a virtual internet bazaar of experts to move technology ideas from lab to market in order to meet the challenges of climate recovery.



Lewis Milford
President and Founder of Clean Energy Group (CEG)
and the Clean Energy States Alliance (CESA)

Matchmaking global experts online for faster clean energy developments

Global demand for energy is projected to more than double by 2050 and to more than triple by the end of the century. At the same time, annual global emissions must decline more than 80 per cent from current levels if we are to stabilise carbon concentrations at a safe level. In the face of these huge energy challenges, governments, businesses and individuals worldwide are seeking economically viable, low-carbon solutions that can be brought to market and scaled up rapidly. Clean Energy Group – a US-based, nonprofit organisation that promotes cleaner energy technologies – proposes bringing these players together through a strategy of ‘distributed innovation’. This approach would create an online web of global experts who can collaborate to move technology ideas from lab to market in order to meet the challenges of climate recovery.

Even with significant energy efficiency improvements, the world in 2050 will still consume between 30 and 40 terawatts (tw) of energy. More than half of this must be carbon neutral (generated without increasing the amount of carbon released into the atmosphere) in order to achieve CO₂ reduction targets. Today, less than 2.5tw of global energy consumption is carbon neutral. By 2050, we must develop and deploy in the order of 20tw of new carbon-free energy – an eight-fold increase.

To put this starkly, we must in 50 years develop a carbon-free energy infrastructure larger than our entire

existing energy infrastructure – all the power plants, vehicles, industries, and buildings on the planet today. To meet this massive challenge, we must not only accelerate deployment of existing technologies but also radically speed up technological breakthroughs.

An unprecedented innovation challenge

Breakthroughs in the cost, performance, and scalability of climate technologies are necessary. The reason is simple: existing climate technologies at current costs and performance cannot meet the demand for carbon-neutral energy. Meeting a challenge of this scope requires innovation in every phase of technology development, from basic research and development to commercialisation and dissemination.

A 2007 study found that existing carbon-neutral energy sources could only supply 10 to 13tw of power by 2100 – less than half that needed to stabilise carbon dioxide, even at an unacceptable concentration level of 550 parts per million (ppm) in the atmosphere. Breakthroughs in new as well as existing energy technologies and sources will be required for stabilisation at 550ppm, and even more to reach 450ppm, the level many scientists deem necessary.

Most experts agree that climate change recovery requires not only government-driven emissions caps but also aggressive innovation in climate technology. Accelerating innovation requires an internationally

coordinated product research and development system to manage, coordinate, and speed innovation through global partnerships among private, government, academic, and nonprofit organisations.

One such strategy is distributed innovation (DI), a modern collaborative method that channels dispersed and multi-sector expertise in alternative energy or product development into common efforts. DI is a well-documented approach to product development in corporate and public-goods sectors. It should be used to shape climate technology strategies and institutions. It is cheaper, virtual, and collaborative. It would encourage new public and private partnerships. Most importantly, it would bring vitality, insight, and new solutions to the most difficult technology turnover challenge the planet has ever faced. Wasting time on the old solutions makes little sense when more modern and effective forms of international collaborative innovation are waiting to be used.

Accurately distributing the expertise

How do we bring expertise that is widely distributed around the world to bear on developing specific products to meet either worldwide or local climate change challenges? Existing global institutions such as the World Bank or the International Energy Agency (IEA) have important missions, but shaping conditions to advance technology innovation challenges is not among them. A new institutional framework is needed at the international level. Whether part of an existing institution or as a new body, an international climate innovation facility would orchestrate innovation by choreographing and coordinating the actions of different types of experts across the globe.

A new facility would support innovative low-carbon solutions by overcoming legal, economic, and other obstacles along the value chain – the range of activities required to bring a product from conception through production to market. The facility would also solve intellectual property rights (IPR) problems and develop new finance and business models. The facility could be modelled after the Global Fund to Fight AIDS, Malaria, and Tuberculosis, an existing public goods institution linked to but independent of the UN and other agencies. The facility could even be virtual, removing the need for a new brick-and-mortar centre.

The facility would employ the bottom-up, collaborative DI approach that has solved complex problems in private and public arenas. Some key characteristics:

- DI employs modern information technologies to link people of diverse expertise in different institutions and countries to work collaboratively on specific product development and deployment projects;
- DI connects specialists based in different sectors, including governments, private corporations, nonprofit organisations, and finance entities, as well as technologists and academic researchers;
- DI accelerates deployment of specific technologies.

DI increases the speed and depth of knowledge dissemination beyond what is possible in conventional information-sharing and institution-linking networks. DI uses innovation platforms and other new

matchmaking infrastructure tools that can potentially enable tens of thousands of people who otherwise never could have collaborated to review challenges and propose solutions. Contributors could be rewarded, with financial incentives for solution providers, cash awards for technological solutions, or a negotiated value for intellectual property rights.

A DI approach would spur new international partnerships among governments, institutions, and individuals in developed and developing countries by building early linkages among all relevant actors (e.g., academic researchers, national laboratories, government agencies, private companies, financiers, utilities, installers, state deployment funds, and others). The partners would work together in the research, development, and financing processes. The result would be new, innovative, and synergistic cross-functional teams that bring opportunities to investors, funding for innovators, and solutions for consumers.

DI should be used to shape climate technology strategies and institutions. It is cheaper, virtual, and collaborative.

This decentralised, bottom-up approach would improve global climate technology research and development policy by;

- Supporting the acceleration of breakthrough clean energy technologies and the scale-up of existing technologies by focusing on all elements of the value chain from lab to market;
- Being product-focused – rapidly driving upstream research to downstream deployment within defined timeframes;
- Addressing the whole technology value chain by filling in the gaps that block effective accelerated deployment;
- Producing a replicable model for a broad suite of low-carbon technologies that could benefit from distributed innovation.

With this approach, a true portfolio of technology options can emerge, with initiatives maturing on different time scales – from short-term solutions to reduce emissions almost immediately, to mid-range commercial opportunities in the next five to 10 years, to longer-term energy innovations not yet imagined.

Coordinating key players from the funding and finance communities early on in the research and development process would assure more efficient use of public and private funding. Investment capital could more easily shift from individual, ‘siloed’ research projects toward specific product-focused projects. DI tools create incentives for private capital to finance technology earlier.

Current obstacles to innovation

According to clean energy studies by the World Bank and the Stern Review on the Economics of Climate Change, several barriers inhibit public and private investment in clean energy research and the development, scale-up, and cost reduction of existing technologies:

- Carbon emissions are priced variably or not at all, creating too much risk in climate policy. This limits private investment in climate technologies;
- Recognised valleys of death – certain points in the development process when significant funding is needed – inhibit private investment;
- It is difficult to attract enough capital without reducing investor risk through specific government support;
- The technology needs of developing countries are especially underserved because of barriers specific to their condition, such as lower incomes and dispersed population.

Cap-and-trade alone won't work

Global experts agree that a market-based cap-and-trade system alone will not deliver emissions reductions and technology innovation at the scale and speed necessary to address climate change fully. The Stern Review agrees that carbon pricing must be complemented by measures to develop technologies. Nicholas Stern writes, "... uncertainties and risks both of climate change and the development and deployment of the technologies to address it are of such scale and urgency that the economics of risk points to policies to support the development and use of a portfolio of low-carbon technology options."

There is virtually no dispute about that from any reputable organisation, including the Group of 20 Finance Ministers and Central Bank Governors (G20), the World Bank, the Intergovernmental Panel on Climate Change (IPCC), the IEA, and the United Nations Framework Commission on Climate Change's (UNFCCC) Expert Group on Technology Transfer.

Overcoming technological, economic, and political roadblocks

A number of centrally coordinated, international DI programmes have resulted in successful technological innovations. In Kenya and Ghana, DI has been used to remove market barriers, such as difficulties in safe processing, in the production and delivery of cassava, maize, and dairy products. The project demonstrates how the approach can produce concrete results in developing innovative technological solutions for industries requiring accelerated product development in difficult markets.

Lighting Africa serves as a partner clearinghouse to facilitate international collaboration among an assembly of public and private sector partners. It is modelling a DI approach to accelerate product development to bring modern, off-grid lighting products to this bottom of the pyramid population. Starting with lighting and advancing to additional energy services, Lighting Africa acts as broker between private companies and customers to create markets for better products.

DI has also been used to accelerate product development in the highly technical area of advanced marine-based renewable energy solutions. While the opportunity for marketing these products is significant, development costs are extremely high and funding is more difficult to obtain. An internationally coordinated market acceleration approach that taps distributed knowledge and experience could support rapid cost reduction and remove other barriers.

Structural reform is critical

The technology innovation required is so great, and the roadblocks so significant, as to require a structural reform at the international level. Indeed, many countries, including members of the European Union, are already well aware of the benefits of international collaborative research and development, including "pooling financial resources, sharing risks and setting common standards for large or relatively risky R&D projects ... and supporting technology deployment in and technology transfer to developing/emerging countries," according to research by the European Commission.

The world is searching for new ways to collaborate on climate technology innovation. The need for collaboration is obvious and well-documented. A challenge of this scale requires creative new strategies and structures beyond conventional networks, information sharing, and bilateral research programmes. Also needed are ways to accelerate product development and innovation and to scale up clean-energy technologies.

Lewis Milford is President and Founder of CEG and the CESA, two nonprofit organisations that work with state, federal, and international organisations to accelerate the commercialisation and deployment of clean energy technologies. Prior to these roles, he was Vice-President of environmental organisation, Conservation Law Foundation, where he headed up their Energy Project and was involved in negotiating restructuring laws to create new public investment funds in clean energy. An author and lawyer, Lewis Milford has written extensively about climate change and clean energy technologies for the US national press, including the New York Times and Boston Globe.

CEG is a nonprofit organisation working with public officials across the US who are collectively responsible for more than US\$6 billion in new clean energy funds. Also under CEG management is the CESA, an organisation to assist these funds when used for multi-state projects. It manages the UNEP Sustainable Energy Finance Alliance, that brings together public investors from around the globe interested in efforts to build clean energy markets and develop low carbon technologies.

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Smart energy management drives environmental sustainability



Anne Larilahti
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Advanced communications technology has an important role to play in sustainable development. In the energy sector in particular, information and communications technology (ICT) has the potential to slash energy use and significantly improve energy efficiency. ICT is being deployed in novel ways across all stages of the energy production and consumption cycle, revolutionising energy systems and infrastructure such as the electricity grid, electric motors, logistics and energy use in buildings. Incorporating ICT into our energy supply networks will be key in the transition to a low-carbon economy.

The ICT sector is only responsible for two per cent of greenhouse gas emissions and has the potential to reduce this. ICTs can also make important contributions to the reduction of emissions in other sectors. This was one of the main conclusions of the *SMART 2020 report* (2008), published by the Climate Group and Global eSustainability Initiative (GeSI).

At the moment, energy utility networks in particular are undergoing a fundamental change, evolving from centralised to distributed architectures, making two-way communication critical to operational efficiency. Among other things, two-way communication helps suppliers provide energy on demand as well as reduce peak loads through intelligent energy consumption.

Smart grids are driving the integration of utility and ICT networks and, as the two infrastructures converge, energy utilities can make use of the proven experience of the telecommunications world. The two infrastructures have many similarities, including the need to reduce complexity and control costs, manage the traffic explosion, drive environmental sustainability and maintain customers.

Smart grids, smart metering and eMobility have the potential to bring new competitive forces to the utilities market. Energy utilities need partners that can help them

transform their operations and adapt to new sustainable business models. Nokia Siemens Networks' strong capabilities and proven expertise in the telecommunications world can help utilities as they adopt smart grids.

Supporting sustainable power

Software skills and experience of dynamic network changes in telecoms are directly transferable to other sectors. Over the past three years, Nokia Siemens Networks has been focusing on innovations to manage electricity grids more effectively.

Smart grids and smart meters are two of the main enablers available for utilities as they seek to optimise the production and consumption of electricity. Governments are now starting to invest heavily in smart grids: the US is calling for the installation of 40 million smart utility meters while the Chinese government leads the way with investments in smart grid technology projects this year totalling US\$7.3 billion.

From the demand side, the key focus is on improving energy efficiency as both consumers and companies look for ways to control their energy use and expenditure in real time. Trials have shown that peak loads can be reduced by 20 per cent by simply making the information about the amount and cost of consumption available to consumers. Smart meters will also help in reducing CO₂ emissions as they support feeding power into the grid from local, renewable generation. This makes it possible to offer more varied tariff structures to help balance peak loads and make better use of off-peak supplies.

Mobile phone technology and billing in the energy sector

Nokia Siemens Networks smart metering solution is based on the same billing software being used by

communication service providers (CSP) serving more than 500 million telecoms subscribers around the world.

From the supply side, utilities aim to optimise energy generation, delivery and their own operations, using smart grids to produce and deliver electricity more efficiently. Reducing their carbon footprint and making sure energy production is as environmentally conscious as possible is a key priority.

Utilisation of 4G mobile broadband communication technologies in the deployment of smart grids will also improve efficiency and reliability, speed up development, reduce cost of ownership and maximise revenues.

Below are few concrete examples that illustrate the numerous opportunities that can be achieved with ICT technology across other industry sectors:

Managing erratic wind energy supply

Wind power is variable and erratic, requiring sophisticated management to achieve maximum productivity and supply to the grid. In 2009, Nokia Siemens Networks entered into a partnership with ServusNet, a software provider, to create a management solution for wind farm operators with multiple wind farms across Europe, with hundreds of turbines from different manufacturers. They needed to be able to extract data from different turbine vendors to create a unified picture of energy generation and ensure it matched with their service level commitments.

Using Nokia Siemens Networks Open Element Management System Suite, ServusNet was able to develop software that will help operators to improve wind farm productivity and the predictability of electricity supply.

New smart grid in Helsinki

Nokia Siemens Networks is jointly developing, testing and installing a smart grid in the new Kalasatama district of Helsinki in partnership with Helsingin Energia, a public utility of the City of Helsinki and ABB, the leading power and automation technology group. The project will create sustainable, high-efficiency electric power distribution and services based on modern communication, information and energy technologies.

The companies will develop a variety of solutions, such as ensuring excess power generated from renewable energy sources in the district – such as solar panels or wind turbines – can be fed into the market, enabling electric vehicles to draw electricity from the grid or feed it back in, improving energy storage, and providing more flexibility and transparency in the distribution grid, all of which should help lower electricity consumption and emissions.

The Kalasatama district in the heart of Helsinki will provide living space for 18,000 people and 10,000 work places by 2030.

Electric car charging simplified

Fortum, a Finnish energy company, and Nokia Siemens Networks are working together to investigate how technologies from the telecommunications sector, such as SIM cards, roaming and itemised billing, can be best used to simplify the billing system for the charging of electric vehicles.



As in mobile phone use, a vehicle owner may have a contract with a service provider, using vehicle charging services from multiple charging station operators with the option of flexible payment. This is a logical extension of smart grids: an intelligent charging system to charge vehicles in a grid-friendly manner while also integrating local energy production.

In essence, a number of ICT products and services will be applied in the energy segment to ensure that this industry can meet the requirements for a growing, reliable and sustainable energy supply.

In collaboration with energy utilities, communications service providers and ICT solution companies, Nokia Siemens Networks is working towards a next-generation system where all parties can bring in their competencies and collaborate in meeting the challenges of transforming energy grids into 21st century smart grids.

Anne Larilabti is Head of Sustainability for Nokia Siemens Networks. Together with her team she is responsible for a variety of issues related to corporate responsibility, such as environmental affairs, social performance as well as understanding the relationship between ICT and economic growth and the implications it has for societies and corporations.

Nokia Siemens Networks is a leading global enabler of telecommunications services. With its focus on innovation and sustainability, the company provides a complete portfolio of mobile, fixed and converged network technology, as well as professional services. Operating in 150 countries, its headquarters are in Espoo, Finland.

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Termite inspired ventilation systems help keep buildings cool.



Bryony Schwan
Executive Director, The Biomimicry Institute

Mimicking nature to mitigate climate change

As scientists and policymakers scramble for solutions to mitigate climate change and reduce the anthropogenic emissions of greenhouse gases, much of the discourse has focused on carbon dioxide (CO₂) sequestration. How can we capture CO₂ and lock it away below the Earth's crust? Yet, while we view carbon as a problem, nature views it as a resource and an essential building block.

When it comes to climate change, our problem-solving methodology so far has taken the standard high-tech, high-risk, 'band-aid' approach. But what if we could, like nature, consider carbon not as a problem but as a building material? That's essentially what Dr Brent Constanz and his company, Calera, have done. The CO₂ emitted by coal- or gas-fired power plants is captured and converted into calcium and magnesium carbonates for use in manufacturing carbon-negative products such as sand, aggregate, supplementary cementitious materials, and cement, as well as fresh water.

According to the company, "the heart of the Calera process is the formation of novel, metastable calcium and magnesium carbonate and bicarbonate minerals, similar to those found in the skeletons of marine animals and plants, by capturing carbon dioxide from flue gas and converting the gas to stable solid minerals." The company refers to this process as mineralisation via aqueous precipitation (MAP) and it essentially mimicks the process of coral reef formation. For every tonne of coal burned, approximately 2.5 tonnes of CO₂ are produced. Using the MAP process,

two tonnes of product can be made from every tonne of carbon dioxide captured.

Cornell University researcher Dr Geoffrey Coates and colleagues at Novomer LLC are also using carbon as a feedstock. Coates has developed a process to make plastic from citrus waste and CO₂. In the same way that plants turn CO₂ into polymers (sugars and polysaccharides), Coates's catalyst allows CO₂ from waste gases to be the feedstock for polycarbonates that ultimately return to the Earth (they're biodegradable).

According to Novomer, their "groundbreaking technology allows carbon dioxide and carbon monoxide to be cost-effectively transformed into polymers, plastics and other chemicals for a wide variety of industrial markets. [Whereas] other environmentally friendly materials utilise expensive, limited, food feed-stocks and costly biological production processes, Novomer uses CO₂ as a major input in a competitively priced, precision-quality, chemical process that produces a class of uniform polymers, plastics and other chemicals."

So the question arises, how else could nature help us address climate change? Are there other strategies in nature that could help us fix carbon, or even better, help us develop technologies that eliminate or reduce carbon and other emissions in the first place? Biomimicry identifies just such a solution set – strategies invented and fine-tuned through evolution. Whether in energy, material manufacture, healthcare, recycling, chemistry, engineering, computing, or trade, organisms have managed to do everything we want to do without guzzling fossil fuels, polluting the

planet, or mortgaging their future. In fact, recent studies of human and non-human 'patents' have shown that industrial technologies usually involve adding more energy or materials to solve an engineering difficulty, whereas insects, plants, birds, and other animals use elegant design and information to do more with less. Their solutions are built into the structure and organisation of their body parts, into their physiology and behaviour, and into their ecosystem-level connections. Instructively, they have managed to meet their needs while creating and regulating, on a planetary level, the conditions conducive to life.

Biomimicry (from 'bios', meaning life, and 'mimesis', meaning to imitate) is a new science that studies nature's best ideas and then imitates these designs and processes to solve human problems. Here are a few strategies from nature that might help us in our efforts to combat climate change.

The PAX propellor modeled on the ubiquitous logarithmic spiral found in nature.



Ever wondered why you see the same spiral shape everywhere in nature from tornados, whirlpools, shells and lilies to the way seeds are arranged in a sunflower? In nature, liquids and gases flow in geometrically consistent, three-dimensional, centripetal swirling patterns, with far less friction and more efficiency. Jay Harmon of PAX Scientific, a marine biologist turned innovator, has designed fans, propellers and turbines based on this nature-inspired shape that can reduce energy use from 30-70 per cent depending upon application.

There are other lessons in the fluid dynamics or aerodynamic shapes found in nature. Take a humpback whale's flipper, for example, which has prominent nodules called tubercles along its edge to improve fluid flow. In wind tunnel experiments, the scalloped flipper has proven to be a more efficient wing design than the straight and smooth leading edges used on aircraft. Tests show that nodule-edged flippers reduce drag by 32 per cent and increase lift by six per cent. Dr Frank E. Fish from West Chester University in Pennsylvania is now applying this tubercle technology to develop more efficient wind turbines and fans.

There are lots of ways we might look to nature to make our current technologies more efficient, learning from the shapes and designs of other organisms whose survival depends on efficiency. There is perhaps an even bigger opportunity in paying attention to how other organisms derive their energy. While we humans are struggling to wean ourselves off our addiction to oil, the rest of the planet runs primarily on solar energy. Plant biologists and engineers are looking to leaves to help them make smaller and more efficient solar cells. A leaf has tens of thousands of tiny photosynthetic reaction centres that operate at 93 per cent quantum efficiency, producing energy silently with water, sunlight and no toxic chemicals. Mimics of these molecular-scale solar batteries could one day be used to split water into clean-burning hydrogen gas and oxygen, or as computer switching devices that shuttle light instead of electrons. NexTech Materials Ltd. is developing a dye-sensitised solar cell that mimics photosynthesis to maximise light harvesting and increase the efficiency of conversion of sunlight to electricity.

Other alternative energy technologies inspired by nature include microbe-inspired replacement of platinum catalysts in fuel cells and lung-inspired fuel cell optimisation. One reason fuel cells are so expensive is the use of platinum in the membrane that conducts the hydrogen chemistry. Cyanobacteria catalyse this same reaction at extraordinary rates using an enzyme created from abundant metals. Cedric Tard and Christopher Pickett of the John Innes Centre in the UK have successfully mimicked the active site at the heart of the hydrogenase protein. The resulting iron-sulphur framework functions as an electrocatalyst for proton reduction, a potentially important step towards inexpensive materials to replace platinum in the anodes of fuel cells.

“Biomimicry is a new science that studies nature's best ideas and then imitates these designs and processes to solve human problems.”

Morgan Fuel Cell's (UK) patented 'biomimetic' bipolar plate technology (electrodes) drew its inspiration from the branching structures in animal lungs and plant tissues. The bipolar plates of the fuel cell contain two large conduits that feed into a system of capillaries. As with the lung, this maximising of surface area for gas exchange allows gases to flow through the plate in a far more efficient way than has ever been achieved before. The biomimetic bipolar plates are cheaper to produce, and they boost peak power by 16 per cent, while improving water management, enhancing reliability, and reducing backpressure.

Aside from reducing emissions and developing alternative energy, we also need to consider the energy use and emissions associated with manufacturing and here yet again nature has lessons to teach us. Much of

our manufacturing uses the traditional 'heat, beat and treat' technologies but not the spider, nor the abalone sea snail. The spider manufactures silk five times stronger and more flexible than steel using benign, low-energy manufacturing. Abalones manufacture a ceramic considerably more beautiful and durable than any ceramic we have ever produced but in ambient water temperature with no toxic chemicals or high pressure.

Mother-of-pearl, also called nacre, is renowned in scientific circles because it is twice as tough as our high-tech ceramics. Researchers have now developed a nanoscale, layered material that comes close to nacre's properties, including its iridescence. This water-based, low temperature process allows liquid building blocks to self-assemble and harden into coatings that can toughen windshields, bodies of solar cars, airplanes or anything that needs to be lightweight but fracture resistant.

Silicon chips are currently processed in energy intensive and highly toxic ways. Marine sponges, on the other hand, form silica structures in ambient conditions with the help of a protein called silicatein. Researchers at the University of California, Santa Barbara have created a mimic of this protein called a cysteine-lysine block copolypeptide. Lab results confirm that these molecules are able to direct formation of ordered silica structures, just as silicatein does. This creates the possibility of developing a non-toxic, low temperature approach to silica chip manufacture.

Finding a solution to climate change is no easy endeavour and hundreds of organisations and government agencies are working on this issue. However, we do know that the built environment is responsible for much of our energy use and CO₂ emissions. According to the United States Environmental Protection Agency, buildings in the US consume 36 per cent of nation's energy and 65 per cent of electricity consumption. Buildings are responsible for 30 per cent of greenhouse gas emissions.

The opportunities to reduce energy use in buildings by learning from nature are many. Mick Pearce Architects and Arup Engineering collaborated on a mid-rise building in Zimbabwe that has no air-conditioning, yet stays cool thanks to a termite-inspired ventilation system. The Eastgate building is modelled on a local termite species that maintains the temperature inside their nest to within one degree of 31°C, day and night, summer and winter while the external temperature varies between 3°C and 42°C. The Eastgate complex uses only 10 per cent of the energy used by a conventional building of the same size.

Vapour-absorbing insects are inspiring a new building dehumidification device that would absorb moisture in humid air and wick it away for collection using a very small amount of energy. Researchers at the Centre for Biomimetic and Natural Technologies at the University of Bath in England are studying how desert cockroaches gather water to develop a new kind of dehumidifier technology. Dehumidifying air in a city like Atlanta, GA before it is cooled would save on energy (drier air takes less energy to cool), reduce toxic mould, and potentially provide a new source of potable water. According to the National Renewable Energy Laboratory, desiccant systems could potentially save about 400 trillion Btu (British thermal units) of energy each year in US buildings and

prevent the emission of more than 24 million tonnes of carbon dioxide (CO₂) by 2010. Desiccant dehumidification could reduce total residential electricity demand by as much as 25 per cent in humid regions.

Aside from studying individual species and how they have developed elegant, well-adapted strategies, we shouldn't miss the opportunity to look for climate change solutions at the systems level by learning from whole natural ecosystems. Instead of an extractive agriculture that mimics industry, prairie-inspired farming is a self-renewing agriculture that mimics nature while sequestering significant amounts of carbon. Prairies – temperate grass and shrublands – hold the soil, resist pests and weeds, and bolster their own fertility, all without our help. Prairie-like polycultures using edible perennial crops and biofuel candidates like switch grass would, over winter, making ploughing or planting every year obsolete. These mixtures of plants would also give farms resilience, reducing the need for oil-based pesticides.

These are just a few of hundreds of examples of how researchers and designers are creating new technologies that, by following nature's principles, are both highly efficient and environmentally sustainable. After 3.8 billion years of evolution, nature has learned what works, what is appropriate, and what lasts.

[Additional research provided by Janine Benyus.]

Bryony Schwan is Executive Director and co-founder of The Biomimicry Institute, a non-profit organisation that promotes the new science of biomimicry. Schwan is also an affiliate faculty member at the University of Montana where she teaches in the Environmental Studies programme. Prior to this, she worked for 11 years as the Executive Director and then National Campaigns Director for Women's Voices for the Earth (WVE), a non-profit environmental justice organisation that she founded in 1995. Born in Zimbabwe, she moved to the US in 1981. She has an MS in Environmental Studies from the University of Montana.

The Biomimicry Institute, co-founded in 2005 by science writer Janine Benyus, is a non-profit organisation that promotes the study and imitation of nature's remarkably efficient designs in creating sustainable technologies. Benyus also co-founded the Biomimicry Guild, which brings scientists, engineers, architects and innovators together to collaborate and develop green, nature-inspired solutions. The Biomimicry Institute does not conduct its own research but serves as a clearinghouse and resource for those who do. Biomimicry is a new science that studies nature's best ideas and then imitates these designs and processes to solve human problems.

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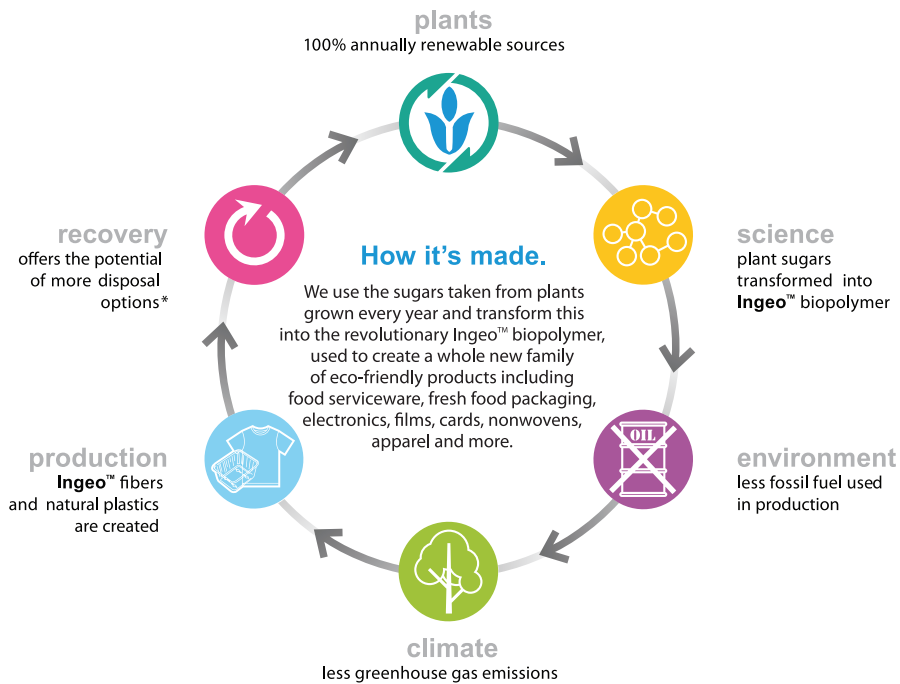


a journey of innovation for better choices



As the world grows progressively more concerned with its own environmental future, discussions on sustainability and ecology have multiplied. Much attention is given to the world-changing themes and projects sponsored by international organisations and governments with considerably less space given to what individuals and businesses can do to lessen their environmental impact on a daily basis.

NatureWorks LLC is a company dedicated to more sustainable product development and the first to offer a family of commercially available low carbon footprint polymers from plants, not oil, known as Ingeo™, created to offer simple choices for the consumer everyday. The production of Ingeo™ uses less fossil fuel and emits fewer greenhouse gases than conventional polymers (see graphic), making it possible to create everyday consumer items that are better for the planet.



*learn about end-of-life options in The Ingeo™ Journey at www.natureworkslc.com

Since 2003, NatureWorks has innovated across a wide range of products for:

- food packaging • food serviceware • automobile
- consumer electronics • durable goods • apparel
- homeware • personal care

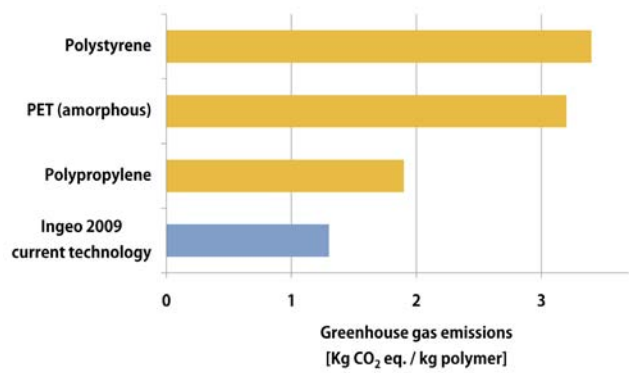
Due to NatureWorks constant two-way collaboration with end product producers, Ingeo™ is currently being used over 40 different new lifestyle product families. Products made from Ingeo™ are produced by more than 1.000 brands and retailers and sold worldwide in over 70.000 locations.



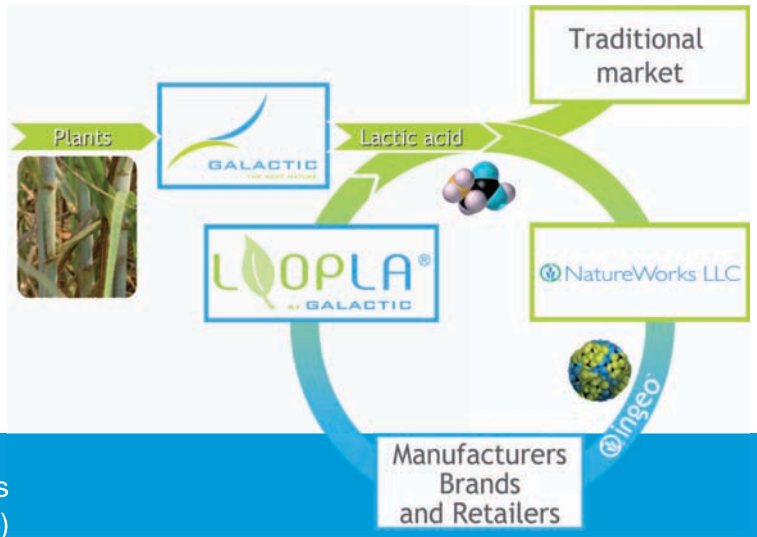
A carpet made from Ingeo™ used at the Copenhagen climate change conference in 2009.

NatureWorks is also constantly at work to improve its revolutionary product. One area of study in particular involves the development of a recovery process for Ingeo™ products after their useful life, sourcing from both post-consumer and industrial streams, into lactic acid - the building block for the Ingeo biopolymer. The Ingeo™ path to being a true “cradle to cradle” product is becoming reality as new entrants in the market such as Galactic in Europe, and BioCor in the US have started to convert post industrial and, increasingly, post consumer Ingeo™, back into lactic acid. One sample application of the

process has seen the Sommer Needlepunch conference carpet (pictured above) used last year at COP-15, renewed into pure lactic acid for use in other products. What has the industry’s strong interest is that this relatively simple recovery process – basically, heating Ingeo™ with water – can be applied to any Ingeo™ product. Whether it’s food packaging, flexible films, bottles, durable products, or apparel, home textiles, nonwovens, or even carpet, as the COP-15 experience demonstrated, the material can be readily ‘disassembled’ into the same lactic acid building block for re-use.



Source of the graphic above: Vink, Kolstad, and Davies, “The eco-profile for current Ingeo™ polylactide production”, Industrial Biotechnology, Vol 6, No. 4, August 2010, pp 212-224.



NatureWorks is partnering with ClimateAction, at this year’s UNFCCC’s Conference of the Parties (COP-16) in Cancun, Mexico. The project’s goal is to share how NatureWorks’ Ingeo™ innovation partners are contributing to COP-16’s and Climate Action’s goals by demonstrating how every single individual and company can do something tangible for the environment.



Rudy Provoost, CEO of Philips Lighting
Martin Goetzler, CEO of OSRAM

A global transition to efficient lighting

The demand for electricity is set to rise dramatically. For lighting alone, electricity consumption is expected to increase by 60 per cent in the next 20 years. Today, lighting is responsible for 19 per cent of global electricity consumption and for six to eight per cent of global greenhouse gas emissions (GHG). The good news is that the technology is here to enable a global transition to lighting efficient enough to slash emissions by half.

The move to energy efficient lighting

Lighting worldwide is responsible for 1,900 million tonnes of CO₂ a year meaning that the potential for reductions in GHG emissions is enormous. Around 40 per cent of future global energy demand for lighting could be avoided by switching to efficient lightbulbs. The shift from inefficient incandescent bulbs to energy efficient compact fluorescent (CFLs) or light-emitting diodes (LEDs) would cut world lighting energy demand significantly, saving countries, businesses and households considerable sums in reduced electricity bills. Few actions could reduce carbon emissions as cheaply and easily as the phase-out of inefficient lighting.

Market forces are not sufficient to achieve the rapid transformation needed in the lighting market to respond to the climate change challenge. Instead, a multi-stakeholder global partnership is required to support countries as they embark upon efficient lighting transformation programmes. As two of the biggest lighting manufacturers in the world, we have chosen to focus our efforts on transforming the lighting market in partnership with UNEP through its en.lighten initiative. With its unparalleled global network, UNEP can provide leadership by inspiring and enabling nations to prioritise efficient lighting and reap the benefits of lowered energy costs.

Whereas activities aimed at phasing out inefficient technologies have been introduced in recent years in a

number of countries, experience indicates that global co-ordination is required to assist countries as they embark upon efficient lighting transformation programmes. Support is necessary to provide countries with the required know-how to make the transition successful, both in terms of the economic gains and the associated reduction of GHG emissions.

A number of countries and regions in the world have initiated successful steps in order to move to efficient lighting. In 2009, the EU banned traditional incandescent bulbs of 100 watts or more, a decision that will save about 32 million tonnes of CO₂ a year. Together with energy efficiency regulations, the ban will save about €11 billion a year (US\$15.3 billion). In Australia, where the legislation of efficiency standards will result in a ban on incandescent bulbs this year, more than 30 terawatt hours (TWh) of electricity and 28 million tonnes of GHG emissions are expected to be saved between 2008 and 2020.

With the above activities as examples of what is possible, the UNEP en.lighten initiative has seized the opportunity to lead the engagement required with developing and emerging countries, governments and the private sector to achieve a global market transformation to efficient lighting.

Private sector and the UN in partnership to en.lighten the world

The UNEP en.lighten initiative was created in 2009 as a partnership between UNEP, Philips Lighting and OSRAM, with support of the Global Environment Facility (GEF). The initiative addresses the challenge of accelerating global market transformation to environmentally sustainable lighting technologies by developing a global strategy in support of the gradual phase-out of inefficient lighting. This will reduce global GHGs from the lighting sector and also reduce mercury released from coal combustion.

The initiative aims to strengthen country, government and private sector capacity to lead successful lighting market transformation programmes through:

- the development of a global policy strategy to gradually eliminate inefficient and obsolete lighting products;
- the promotion of high performance and efficient lighting technologies in developing and emerging nations;
- the substitution of traditional fuel-based lighting with efficient alternatives.

The en.lighten initiative has created global taskforces where international experts from developing, emerging and developed countries and sectors are working on a global approach to phase out inefficient incandescent lamps. Another key element of the initiative is the development of strategies to assist countries in establishing sound collection and recycling systems, an area where we have many lessons and experiences to share.

Off-grid lighting: a solution to the plight of millions

More than 1.6 billion people around the world do not have access to grid-based technology and use over 77 billion litres of kerosene each year for lighting, emitting more than 190 million tonnes of CO₂ per year in the process. Kerosene is dangerous to its users and to the environment. Medical experts warn that kerosene smoke is unhealthy and the open flame lanterns are dangerous.

The presence of artificial light can extend the hours of productivity, often leading to job creation as retailers can stay open longer, construction can continue into dusk, small local industries can thrive and evening education classes become more viable. According to the World Bank, poor infrastructure is responsible for a growth rate reduction of at least two per cent in Africa.

“The challenge of this generation is to deliver energy to the billions of people around the world without access to the grid in a way that does not contribute to humanity’s global environmental footprint, including impact on the climate,” said Achim Steiner, UN under-secretary general and UNEP executive director. “To do this we need innovative and creative solutions and partnerships that bring together governments, businesses and communities in common cause.”

The private sector has become involved with various projects such as the OSRAM ‘Umeme Kwa Wote’, meaning Energy for All, an off-grid project which began in April 2008 in Nairobi, Kenya. The efficient lighting project has seen the establishment of energy hubs around the Kenyan shores of Lake Victoria and in Uganda. The hubs offer customers with a leasing model for solar-charged mobile lighting systems that can replace kerosene lanterns both for night fishing and home use. Additionally, the energy hubs offer the service of charging mobile phones and selling clean drinking water that has been treated by a solar-powered UV-filtration plant.

Philips has been working with NGOs in Ghana on domestic solar-powered lighting solutions since early 2008 and in November 2009 announced the world’s first self sustaining solar-powered LED football floodlighting solutions. For the first time, in both Kenya and South

Africa, communities were able to enjoy games of football in the evenings in areas which had never witnessed electric light before.

Through the UNEP en.lighten initiative and on the basis of the successful experiences we have gained in African countries, we aim to provide support to developing and emerging countries in setting the appropriate frameworks needed to accelerate the spread of off-grid lighting technologies, bringing light to those who need it.

***Martin Goetzeler** is President & CEO of OSRAM. He joined OSRAM as CFO in Italy and became Managing Director of OSRAM UK in 2001. From 2002 he was the CFO of OSRAM SYLVANIA in Danvers, USA. Since May 2005 Martin Goetzeler is the President & Chief Executive Officer of OSRAM, one of the two largest lighting manufacturers in the world.*

***Rudy Provoost** is Executive Vice-President and CEO of Philips Lighting, member of the Board of Management, Royal Philips Electronics and Chairman of the Philips Sustainability Board. Mr. Provoost joined Philips in October 2000 as CEO of the European regional sales and was appointed CEO of the Consumer Electronics division in 2004 and to the Board of Management of Philips in 2006.*

***Philips Lighting** is a leading provider of lighting solutions for homes and workplaces to public spaces, sports arenas and the outside lighting of architectural icons. In 2009, the company pledged to improve the efficiency of its overall product portfolio by 50 per cent by 2015 and double both its recycling rate and use of recycled materials in new products.*

***OSRAM** was founded over 100 years ago and is headquartered in Munich. It focuses on high-tech efficiency and over 66 per cent of sales are generated from energy-efficient products. OSRAM’s work in helping families in developing countries switch to energy-saving lamps won approval as a UN Clean Development Mechanism (CDM) for its contribution to cutting CO₂ emissions.*

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Sustainable business practice

Business can no longer afford to relegate environmental issues to the back burner and pretend that the challenge posed by greenhouse gas emissions should be the sole preserve of NGOs and governments.

Since the scientific community irrefutably established the causal link between increasing carbon emissions and human activity, the quest to reverse the negative impact of environmental degradation has taken centre stage.

As a leading telecoms player with operations in Africa and the Middle East, MTN Group is acutely aware of the devastating effects of climate change in the countries in which it operates. Many of these countries are the most vulnerable to the effects of climate change and have few, if any, resources to offset its adverse impact.

MTN has made a concerted effort to identify areas where it can reduce its carbon footprint. Addressing energy efficiency and investing in alternative and lower-carbon technologies are a key means of reducing the company's impact.

Examples of efforts in this respect are indicated in the map on the opposite page. These include powering base transceiver stations and switching sites with a combination of renewable, lower carbon and engineered solutions. Trial and live sites from South Africa to Nigeria deploy wind, solar, deep cycle batteries, waste heat capture and other energy efficiency solutions which help reduce the company's environmental impact.

MTN can influence energy efficiency in other sectors of the economy by developing innovative solutions. These would help improve how other industries operate and how society works and lives. The company is actively exploring and considering solutions such as dematerialisation (replacement of physical

services with virtual solutions), efficiencies in transport logistics, smart building technologies and information solutions for energy efficiency imperatives and improved grid management and monitoring.

For MTN therefore, implementing

sustainable business practices throughout its operations is not a matter of compliance, but a business imperative that makes economic sense and enhances stakeholder value.



Case study: Riemvasmaak

Communities remain an important stakeholder in MTN and the company endeavours, wherever possible, to integrate and empower them in its operations.

In the remote village of Riemvasmaak in South Africa, MTN built two off-grid wind- and solar-powered base stations for this community that has, until now, lacked any telephony connectivity.

The Riemvasmaak community were co-opted in the building of the sites, thus contributing to their economic well-being. This new-found link with the outside world has gone a long way towards reviving the local economy.

Case study: Zambia

Zambia has historically had low access to telephony services. This is compounded by a low population density, increasing the spread of coverage needed and low electrification rates. To support the demand for increased access to affordable communications, MTN Zambia has deployed hybrid solutions across almost 20% of its network.

This has seen an increase in MTN's capacity to service communication requirements at acceptable quality levels while reducing fuel consumption and related costs by 37% across the entire network. MTN has also reduced associated greenhouse gas emissions from diesel-based power consumption. Network performance has substantially improved – power generators now operate under 40% of previous configurations.

As part of the plan to ensure wider benefit from these initiatives, MTN Zambia is planning to set up community centres at selected sites, allowing subscribers and the community to charge their mobile phones from points supplied at sites for this purpose. Public payphones are also being set up at such sites.

– an imperative for MTN



Launched in 1994, the MTN Group is a multinational telecommunications group, operating in 21 countries in Africa, Asia and the Middle East. The MTN Group is listed on the JSE Securities Exchange in South Africa under the share code: "MTN". As at 30 September 2010, MTN recorded 134,4 million subscribers across its operations in Afghanistan, Benin, Botswana, Cameroon, Côte d'Ivoire, Cyprus, Ghana, Guinea Bissau, Guinea Republic, Iran, Liberia, Nigeria, Republic of Congo (Congo Brazzaville), Rwanda, South Africa, Sudan, Swaziland, Syria, Uganda, Yemen and Zambia. Visit us at www.mtn.com

	Hybrid solar, wind, other
	Solar
	Fuel site management
	Hydrogen fuel cell
	Fuel leakage new pipe technology
	Green buildings (LEED)
	Dairy bio-gas
	Natural gas
	Diesel combustion enhancer
	Deep cycle/high energy density battery
	Monitoring: energy, battery, weather variables
	Combined heating/cooling
	Wind

MTN, Africa's leading mobile operator



everywhere you go



ICTs are uniquely important in combating climate change



Dr Hamadoun I. Touré
Secretary-General of the International
Telecommunication Union (ITU)

From mobile smart phones to broadcasting to emergency communications, information and communication technologies (ICTs) are a crucial part of our everyday lives and of countless administrative and industrial processes. These vital technologies are energy hungry and have an environmental impact throughout their lifecycle. But they are also uniquely powerful tools for reducing emissions in almost every sector and play an essential role in climate science.

Reducing ICT's carbon footprint – and everyone else's

ICTs offer an immense opportunity to reduce greenhouse gas (GHG) emissions across the board, especially in those industries that are among the highest producers of CO₂, such as energy generation, waste disposal, construction and transport. For example, ICTs provide means for virtual meetings, immediately cutting out the need to travel. It has been suggested that if 20 per cent of business travel in the EU was replaced by video and web conferencing, it would save 22.3 million tonnes of CO₂ a year.

Experts have estimated that some 2.5 per cent of global emissions are caused by the ICT industry (mainly through the consumption of electricity), excluding broadcasting and related radiocommunications. The figure is likely to rise substantially as the use of ICTs spread, despite efforts by the industry to improve efficiency. A large data centre, for instance, could have the energy requirements of a medium-sized city.

According to ITU statistics, the number of mobile phone subscriptions worldwide rose above five billion in 2010, and by the end of this year, more than two billion people will be online. This enormous growth, coupled with new, power-hungry applications, will lead to increasing energy consumption. Some analysts suggest that the energy used by ICTs in Europe alone may grow to 10.5 per cent of total consumption by 2018.

But, crucially, deploying ICTs can massively reduce the emissions produced in other sectors. According to the G20 ICT Sustainability Index 2009, 5.8 billion tonnes (gigatonnes) could be eliminated by 2020 “through the focused use of ICT-based solutions”.

The broadband boost

Advanced networks that give broadband internet access allow governments, companies and individuals to not only use new services such as telemedicine and online education, but also to achieve substantial energy savings – especially when used as part of an integrated broadband system across all sectors. And the electricity industry itself is of major significance.

According to the World Energy Council, electricity generation is the single largest contributor to global CO₂ emissions – around 40 per cent of the total. Significant reductions will be made through broadband-enabled ‘smart’ electricity grids that allow for efficient generation and distribution of energy. In addition, smart grids make it easier for locally generated electricity (including from renewable sources) to be integrated, stored and shared as demand fluctuates across the grid. Some US studies have suggested that smart grids could generate savings of between 10 and 25 per cent in electricity demand.

In May 2010, ITU together with UN Educational, Scientific and Cultural Organization (UNESCO) launched the Broadband Commission for Digital Development (www.broadbandcommission.org), to promote the adoption of practices and policies that enable all countries and communities to experience the benefits of broadband. The Commission's members are leaders from governments, relevant industries, international agencies and development organisations. They presented a report to UN Secretary-General Ban Ki-moon in September 2010, highlighting the central role of ICTs in accelerating progress to achieve the Millennium Development Goals (MDGs) by the target date of 2015.

ICTs in measuring and monitoring

Most observers agree that ICTs can save much more CO₂ than they produce. But it is hard to find consistent figures that show this on a large scale. A transparent and standardised way of accurately measuring both the pollution impacts and the 'cleaning' power of ICTs is needed. We need to see figures we can trust if fair comparisons are to be made on a global scale – and this has important implications for the COP process.

Methodologies for measurement

In October 2010, a study group of ITU's Standardization Sector began the approval process of a new standard that sets out a framework for evaluating the environmental effects of ICTs and outlines methodologies to assess these impacts in terms of goods, networks and services, as well as the use of ICTs in organisations, cities, and even whole countries.

In future, it should be possible to make valuable comparisons of ICT-related emissions using agreed and transparent methodology. A factory in Croatia, for example, could be measured against similar premises in China or Canada. A factory owner could then look at the current impact of his operations and calculate the potential CO₂ savings that could be made through ICTs.

It is anticipated that the new standard will be published in final form in early 2011. Under its umbrella, further, more detailed standards on specific areas are expected to be provided from 2012. The results will also be fed into work on the Clean Development Mechanism, defined in the Kyoto Protocol.

These methodologies could prove invaluable in providing a trusted means of measuring the impact of ICTs. International carbon markets can function largely because a trusted 'currency' exists to measure emissions in many contexts. A standardised means of measurement does not yet exist for ICTs. The new standard will begin to correct this and offer a way to include the powerful influence of ICTs in calculations of how to combat climate change.

Monitoring the planet

ICTs are also fundamental to climate science in the gathering, processing and analysis of data. The role of ICTs is clearly shown in the World Meteorological Organization's World Weather Watch (WWW). At its core is the Global Observing System (GOS), which uses satellites and remote sensing equipment on land, sea and in outer Space.

Another component of WWW is the Global Data Processing System, which links thousands of ordinary and super computers to process enormous volumes of meteorological data to generate warnings and forecasts, as well as for modelling the Earth's atmosphere. And all of this data can be shared – almost instantly and in huge amounts – through broadband networks.

The services provided by GOS rely on having sufficient radio spectrum and allocated frequencies that remain free of interference. The need to co-ordinate such arrangements internationally is one way in which ITU's Radiocommunication Sector plays an essential role in climate monitoring.

ICT are crucial in emergencies

When natural disasters hit, ICT, in many forms, become a critical part of the response. Because terrestrial communication networks are vulnerable to disasters (or, in many remote areas or developing countries, might never have existed in the first place), wireless systems provide a highly cost-effective and reliable alternative for humanitarian teams to communicate with each other or the outside world, and to provide victims with such facilities as telemedicine.

Wireless and satellite broadband communication equipment can be moved to disaster sites and deployed rapidly. The ITU has been active in sending such systems to afflicted areas, most recently following the Haiti earthquake in January 2010.

Broadband and other communication systems also play a critical role in boosting a country's preparedness to deal with natural disasters and emergencies. They allow for reliable data-gathering and alerts, and enable civic authorities, organisations and individuals to receive early warning of any impending threat.

The ITU's Telecommunication Development Sector assists with the rapid deployment of emergency communications and organises workshops on introducing ICTs for climate monitoring in developing countries and the use of remote sensing technologies in disaster management. The Sector is also helping countries adapt to the impact of climate change. In low-lying nations at risk from sea-level rise, the ITU provides ICT tools for implementing adaptation measures and early-warning systems.

A call to action

I call on everyone at COP 16 to recognise that ICTs must be a key component of efforts to mitigate climate change. And let us work to raise awareness worldwide of their fundamental role in achieving what climate change threatens so severely: sustainable growth and development.

Dr Hamadoun Touré is Secretary-General of the ITU. In October this year, he was re-elected to serve a second term. He was previously director of the Telecommunication Development Bureau (BDT), the executive arm of the ITU's development sector. He is strongly committed to projects such as the Pan-African Telecommunications Network.

ITU, based in Geneva, is the leading UN agency for information and communication technology (ICT) issues and the global focal point for governments and the private sector in developing networks and services. For 145 years it has co-ordinated the shared global use of the radio spectrum, worked to improve telecommunication infrastructure in the developing world, and addressed the global challenges of our times, such as mitigating climate change and strengthening cybersecurity.

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your sustainable telecoms partner offers:

- | | yes | no |
|--|--------------------------|--------------------------|
| 1. the most robust organizational commitment to sustainability | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. constantly improving energy efficiency and carbon reporting | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. best-in-class sustainability consulting | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. the broadest portfolio of sustainable telecoms offers | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. outstanding and innovative solutions for a greener world | <input type="checkbox"/> | <input type="checkbox"/> |

5 yes's, we are probably already partners

less than 5, see you soon!

Orange leads Europe's sustainable telecoms market

Verdantix, an independent analyst firm focused on sustainable business, identified Orange as the only Leader in Europe's sustainable telecoms market in the first study of its kind in 2009. Orange maintained its market leadership position in the 2010 Verdantix study.

"Among Europe's leading telecoms operators, only Orange stands out as a firm that has made deep and broad commitments to launch innovative sustainability offerings for their customers," said David Metcalfe, Verdantix director and telecoms industry veteran.

Orange is proud of this leading position and commits to go on designing ICT solutions for a greener world.



Innovative water features at Zhangjiawo (near Tianjin), China.



Jerry Yudelson
Author and founder of Green Buildings Consultancy Practice
Yudelson Associates

Conserving urban water resources cuts greenhouse gas emissions

Urban water supply, treatment and sewage disposal consume significant amounts of electricity and fossil fuels, almost unnoticed. Without acting to reduce urban water consumption, planners can overlook a significant means of reducing carbon emissions. Fortunately, there are effective water conservation tools available to policymakers such as pricing, regulation, education and incentives. Green buildings and sustainability expert, Jerry Yudelson, proposes a 10-step programme for preventing urban water crises, while at the same time cutting carbon emissions from the water cycle.

Electricity generation requires significant water supplies in most situations, whether in a thermal power plant fuelled by coal, oil, natural gas (methane) and nuclear, or in concentrating solar power (currently the most cost-effective form of solar power generation). For plants located along coastlines, seawater can be used for cooling but, for power plants located inland, massive fresh water withdrawals are required. In fact, in the US, nearly half of all freshwater withdrawals are for cooling thermal power plants.

Water supply, however, is also a large consumer of electricity, primarily for pumping, conveyance, water treatment, distribution and sewage treatment processes. When water is transported long distances or withdrawn from ever deeper groundwater sources, significant electricity is needed for pumping. Electricity and/or fossil fuels are also consumed in great quantities in thermal and distillation processes used for seawater and brackish water desalination.

So, there's no escaping this conundrum: Growing populations worldwide will consume ever-greater quantities of water, with greater problems as urban populations grow ever more dominant. In turn, these urban areas will require ever-greater quantities of energy, which will require ever-larger quantities of water for thermal power production.

The Water/Energy Nexus

Water and energy are inextricably linked, now and forever. Without a reliable energy supply, there can be little water supply; without a reliable water supply, there can be only limited energy production. This intimate relationship is called 'the water/energy nexus'. Even a rapid growth in renewable energy supply will not soon solve this problem.

Water and energy are inextricably linked, now and forever. Without a reliable energy supply, there can be no water supply; without a reliable water supply, there can be no energy production.

A centre of excellence for the water/energy nexus in the US is Sandia National Laboratories in New Mexico. One engineer Michael Hightower, who leads many studies of water and energy, says, “In the next five to 10 years, we will see significant changes in energy systems and their need and use of water. The reason behind (this renewed interest in water use and consumption in electric power generation) is a combination of older infrastructure needing to be replaced and new power infrastructure needing to be built that could significantly impact water use and consumption in the next decade and beyond.”

He concludes that there is no ‘magic bullet’ that is going to provide energy supply for growing water demands and water supply for growing energy demands. This situation requires an integrated planning effort that considers future water and energy needs together, one that develops different solutions for different regions within a country, and which relies heavily on water conservation investments and integrated planning of water and energy infrastructure.

The water/energy nexus in California

Studies by the California Energy Commission have calculated the energy intensity of the water use cycle in the state, shown in Table 1. Energy use for the water cycle in southern California, where most water comes from hundreds of miles away, is dominated by conveyance (transportation), because of both the distances involved and lifting water more than 900 metres. In northern California, most of the water supply flows by gravity from the Sierra Nevada Mountains to the urban centres.

In California, water supply and wastewater treatment accounted for almost a fifth of statewide electricity use and 32 per cent of all natural gas use, generating 106 million tonnes of carbon dioxide-equivalent emissions per year. This intensive energy use makes water conservation the single most cost-effective means of greenhouse gas (GHG) reduction in California!

While California might be an extreme case of the energy cost of water supply and treatment, this example illustrates how future energy and water supplies have to be jointly considered.

Table 1. California (US) State water supply energy requirements

Water Use	California	
	(Northern) kWh/million gallons (kWh/ML)	(Southern) kWh/million gallons (kWh/ML)
Conveyance	150 (40)	8,900 (2,351)
Water Treatment	100 (26)	100 (26)
Distribution	1,200 (317)	1,200 (317)
Wastewater Treatment	2,500 (661)	2,500 (661)
Regional Total	3,950 (1,044)	12,700 (3,355)

The effect of climate change on water supplies

Without concerted action, growing urban populations will require considerably more freshwater than is being produced by most countries today and far more than is widely considered available. In addition, global climate change will have adverse effects on current water supplies.

Water supplies will be diminished because of warmer temperatures, greater seasonal and annual fluctuations in rainfall, and reduced summer stream flows.

Most climate change analyses show that water supplies will be diminished because of glacier melt, warmer temperatures, greater seasonal and annual fluctuations in rainfall, and reduced summer stream flows. Therefore climate change will adversely affect our ability to deliver adequate water supplies to meet the demands of growing populations, not only the direct demands for urban water supplies, but also significant demands for agricultural use, energy production and electricity generation, and biofuels production. Climate change will likely decrease our surface water supply capacity and, because of the over-pumping and drawdown of aquifers worldwide, available groundwater supplies will also decrease.

Carbon-neutral water suppliers

Western Water, an Australian water supplier serving parts of suburban and rural Victoria, a state northwest of Melbourne, developed a plan to become carbon neutral by 2017. They plan to do this by increasing the energy-efficiency of their pumps, using solar-powered (photovoltaic) mechanical aerators at sewage treatment plants and buying green power (from solar, wind and biomass resources) from outside suppliers. The net annual reduction in carbon emissions is estimated at 23,000 tonnes. This is a programme that most water suppliers and sewage treatment operators could easily emulate. Based on ratepayer surveys, Western Water found that consumers were willing to pay up to AUS\$30 per year – about US\$2.50 per household per month – to achieve these reductions.

The range of possible solutions

In researching the prevention of urban water crises, I developed a programme that any country, province or city can employ to reduce urban water consumption, increase green jobs and promote social equity in access to clean water. Many countries have already acted to reduce urban water consumption. In the case of extreme drought,

Table 2. The 10-step programme for preventing urban water crises

Measure	Potential savings*
1. Reduce water use in non-residential buildings through pricing and process changes, as well as fixture/appliance retrofits	20 to 40 per cent
2. Reduce home water use through behaviour change and fixture retrofits	20 to 40 per cent
3. Recycle and reuse site-generated greywater, rainwater and blackwater (sewage)	10 to 30 per cent
4. Reduce landscaping water use, both residential and non-residential applications, through use of weather-based irrigation controllers	20 to 40 per cent
5. Create water conservation pricing in rate structures, to penalise high-volume and/or wasteful users	20 to 35 per cent
6. Water utilities provide rebates and incentives for conservation retrofits	5 to 15 per cent
7. Change building codes to allow onsite water recycling	5 to 30 per cent
8. Train green plumbers to identify and install water efficiency measures	N/A
9. Promote water-efficiency labelled homes, fixtures and appliances	5 to 20 per cent
10. Meter and measure water use, eliminate waste, use only water required by plants in each climate zone	5 to 30 per cent

** Not all savings are cumulative, as each reduces demand from a lower baseline.*

Australian urban areas have successfully reduced water use below 150 litres per person per day, as has a concerted effort in heavily urbanised Singapore. By contrast, water use in the relatively water-rich US averages 150 gallons (567 litres) per person per day. The contrast demonstrates the considerable room for improvement that can take place without affecting urban lifestyles.

The 10-step programme

Preventing the next urban water crisis will take a combination of measures that include: introducing new technology, changes in water pricing, environmental considerations, financing infrastructure upgrades, new institutional arrangements and inducing behavioural changes in residents who use the water. In this context, consider this 10-step group (Table 2) of measures behind which water planners and citizens can unite, from the immediately possible to long-term fixes that will depend on the water issues in a specific region, as well as local politics.

Preventing the next urban water crisis will take a combination of measures.

Many of these measures will lead to ‘green jobs’ in the water industry, from performing home and building water audits and renovations to installing rainwater and greywater harvesting systems, etc. Each action leads to both water savings and reduced GHG emissions.

Implementing the 10-step programme

1. The first step is to construct, renovate and operate non-residential buildings to reduce water use, including reducing energy use (in large buildings, this measure also reduces water use in cooling towers). In new

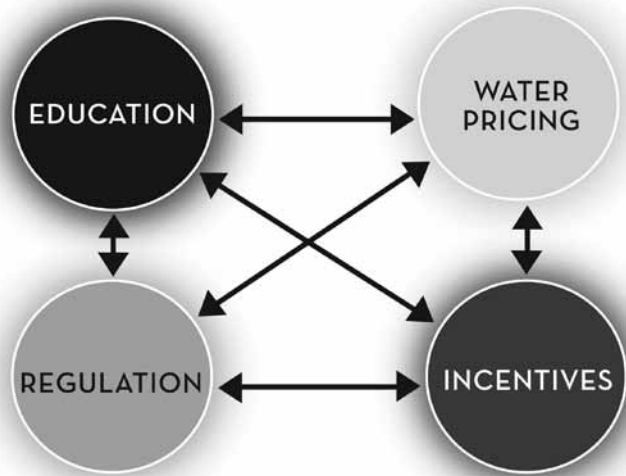
building design, one can mandate use of an accepted third-party rating and certification system, such as LEED, BREEAM, Green Star, CASBEE, etc. In existing buildings, retrofit fixtures to reduce usage by 30 per cent.

2. Reduce water use in the home, starting with water audits, installing efficient technologies and inducing changes in behaviour through education, better real-time information and pricing.
3. Recycle, capture and reuse water more than once, the basic principle behind greywater, rainwater and blackwater (sewage) recycling technology and practice.

Figure 1: A 6-Star Green Star-rated building, Council House 2 in Melbourne, Australia, pioneered an urban innovation, ‘sewer mining’ of blackwater for treatment and reuse in buildings.



Figure 2: Four basic water demand management/conservation tools are regulation, education, water pricing and financial incentives.



© Yudelson Associates.

The key is to match water quality of the supply source with required water quality at the point of demand. Figure 1 shows a creative use of blackwater in cities.

4. Reduce water use in landscaping on building sites, with effective irrigation technology and revised plant choices, emphasising native and adapted vegetation (called 'xeriscaping').
5. Water pricing should be structured so that rates are steeply tiered, rising with increasing use, with at least three tiers – preferably five or more – resulting in significant economic penalties for water waste and excessive water use. This brings market incentives effectively into the picture without harming the poor.
6. Water agencies should focus on conservation measures first; these usually reduce water use by 15 per cent or more. Most urban systems have the potential to reduce their total demand anywhere from 25 to 45 per cent today with relatively straightforward approaches such as reducing infrastructure leakage and imposing outdoor watering restrictions. Figure 2 shows four basic demand management tools for urban water managers.
7. To accommodate new water technologies, codes such as the International Plumbing Code need to be changed to allow for much more on-site treatment and reuse, without losing their essential focus on protecting public health and safety.
8. The entire plumbing industry, including for example more than 40,000 plumbers in the US, needs to be trained in green plumbing practices. By working with water agencies, vocational schools, labour unions and local colleges, many new jobs can be created by retrofitting millions of inefficient fixtures across a country and introducing new efficiency technologies.
9. Rapid adoption of new water efficiency labelling schemes, (such as those found in Australia, Singapore and the US), for new and existing homes, along with other green building and energy performance labels will directly and indirectly reduce water use.

10. Meter and measure all aspects of water uses (this could even be Step 1): 'What gets measured, gets managed.' With today's technology, people can use the internet to get real-time data about their water use. Knowing daily, even hourly, water use in a simple, readable and understandable format can affect behaviour and reduce water consumption.

“The key to reducing urban water consumption is to work on all fronts at once, in a coordinated manner.”

To prevent an urban water crisis and to reduce carbon emissions from the water cycle in your country or region, begin by getting cities and water agencies to embrace the 10-step programme outlined above. Individuals can start at home with a water audit, a series of low-cost and no-cost measures that can reduce water use by 15 per cent right away and installing water-efficiency-labelled appliances as they come available. The key to reducing urban water consumption is to work on all fronts at once, in a coordinated manner, with retrofit incentives, technological and process changes, rate structures, code modifications, public education and technical assistance.

Jerry Yudelson is founder and CEO of the green building and sustainability consulting practice, Yudelson Associates. He is a professional engineer with more than 25 years' experience in water conservation, environmental planning and green building design. He is a keynote speaker at conferences worldwide and the author of 12 books on green building, green homes, green development and water issues.

Yudelson Associates provides consulting services in green building, green development, sustainability planning and technology research for corporate, governmental, utility and institutional clients in North America. The firm provides project management services for LEED green building certification and advises companies on market introduction of green technologies. The firm's research services focus on new energy technologies and markets, largely for corporate and institutional clients.

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Builder of a Sustainable Future



CITY DEVELOPMENTS LIMITED



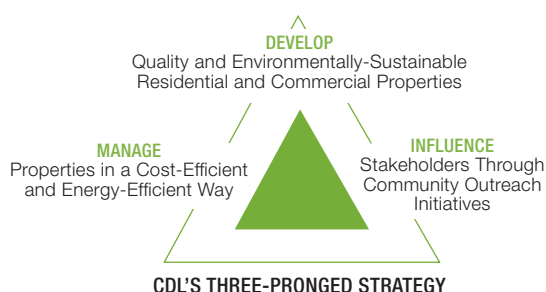
Having developed over 22,000 luxurious quality homes in the past 45 years and as one of Singapore's largest landlords, City Developments Limited has been instrumental in shaping the cityscape with architectural icons. Beyond redefining lifestyles and presenting innovative living concepts, this green developer has also been leading the transformation of Singapore's built environment and social landscape.

According to the Intergovernmental Panel on Climate Change (IPCC), building-related greenhouse gas emissions could almost double by 2030. The building sector is amongst the largest source of greenhouse gas emissions, consuming more than a third of the world's energy.

These startling figures present big opportunities for change. One firm advocate of environmentally sustainable development is Singapore's foremost property developer – City Developments Limited (CDL).

Firmly rooted in the Company's ethos is the belief that a successful corporation is not only founded on financial achievements, but is also shaped by the positive contributions it can make to society and towards environmental sustainability. This approach has remained a guiding principle by which CDL conducts its business and engages with its stakeholders and the larger community.

Since the 1990s, CDL has been setting the benchmark for Green Building in Singapore, taking bold steps towards mitigating the impact of its operations on the environment, and striving to apply environmentally-friendly practices in its business. As part of its corporate green strategy, the Company champions a three-pronged holistic life-cycle approach towards sustainability:



BUILDING CAPACITY IN GREEN INNOVATION

As a testament to the importance CDL places on the environment, it currently invests between 2% and 5% of construction cost of a development on green design and features. The returns of this investment are reflected in the reduced use of natural resources, financial savings and eventually, the possible increased capital value of the development. Moreover, through the implementation of green innovations into CDL properties, it is also helping to develop the industry's expertise and capabilities in adopting sustainable solutions for Singapore's built environment.

CDL has set numerous new industry firsts through the implementation of state-of-the-art technology and green innovation within its residential and commercial developments. One exceptional showcase of a sustainable green building is its 300,000 square feet commercial building, 7 & 9 Tampines Grande, which was completed in 2009.

Designed as a cutting-edge, new generation green office, Tampines Grande features one of the largest and most extensive use of solar technology in a commercial property in Singapore, with Building Integrated Photovoltaic (BIPV) and Solar Thermal panels measuring some 2,080 square metres installed on its roofs and facade that generates 203,000 kWh of clean energy.



Forty customised large sized 152 Wp amorphous silicon thin-film Building Integrated Photovoltaic (BIPV) Panels have been installed on Tampines Grande's facade across an area of 140 square metres to give an output of 6 kWp. The customised BIPV panels form part of the facade cladding, replacing conventional glass that would otherwise have been used.

For the first time in Singapore, an innovative Solar Air-Conditioning System has been incorporated to generate sufficient air-conditioning for the atrium. This, along with other energy-efficient features and the passive low energy architectural design have led to significant energy savings amounting to 2.7 million kWh per year and an overall reduction in CO₂ emissions by approximately 1,400 tonnes per year for the entire building. This development is also the first in Singapore to achieve the internationally-recognised LEED Gold certification under the Core and Shell Category from the US Green Building Council in 2010.

MANAGING ENERGY-EFFICIENT BUILDINGS

In Singapore, buildings account for about one-third of the national electricity consumption. The vast majority of energy consumption occurs while a building is occupied, with more than four-fifths of site energy use typically occurring in the operational phase of a building's life. Through energy-efficient improvements, buildings can reduce their energy consumption, and also reap long-term financial savings.

In line with CDL's ongoing commitment to enhance the energy efficiency of its existing buildings, the environmental performance of each building is closely monitored with a view of implementing infrastructural enhancements or engagement initiatives to further improve efficiency.

A recent example is CDL's Fuji Xerox Towers, a 359,000 square feet commercial building completed in 1987. Following a retrofitting exercise in 2008, which saw the replacement of the chiller system that accounts for the bulk of its energy consumption, a substantial 50% reduction in energy consumption in the chiller plant system or energy savings of 2,378,000 kWh per year was achieved. With the implementation of other energy-efficient features such as ultrasonic and photovoltaic sensors, the building has achieved a 23% reduction in electricity consumption annually following the retrofitting, and an Energy Efficiency Index (EEI) of 138.71 kWh/m²/yr.

CREATING A CULTURE OF AWARENESS

Apart from infrastructural investment for energy-efficiency, change can only be sustained through stakeholder engagement and influence. Leveraging on its sphere of influence as a property developer and landlord, CDL has introduced several engagement initiatives to grow a culture of environmental awareness amongst its stakeholders, including builders and consultants, tenants and homebuyers.

For builders and consultants, CDL initiated the CDL 5-Star Environment, Health and Safety (EHS) Assessment System in 2001, as part of a concerted effort to encourage the improvement of EHS standards at all CDL development sites. This rigorous system of checks and balances has successfully improved the environmental performance at its development sites considerably, with a reduction of between 3% and 18% in water and energy usage, as well as waste generated, at the sites in 2009.

Leveraging on its extensive outreach to its network of office and retail tenants as well as homebuyers and homeowners, engagement initiatives focusing on encouraging the uptake of environmentally-conscious behaviour both in the office and at home have also been introduced. Through such programmes, CDL undertakes the role of an influencer to create a more environmentally-aware community.



City Square Mall, Singapore's first Eco-Mall, was envisioned by CDL as a prototype of an eco- and community-friendly mall that provides a fun eco-learning experience for tenants and shoppers. Designed with environmental sustainability in mind, the 700,000 square feet Mall is equipped with a comprehensive range of innovative green features which collectively reduces over 5,700 tonnes of carbon emissions annually.

TOWARDS A CARBON NEUTRAL FOOTPRINT

In 2009, CDL established the 108,000 square feet office project – 11 Tampines Concourse as the first CarbonNeutral® development in Singapore and Asia Pacific. This milestone achieved was a natural progression of CDL's commitment towards building greener properties – and a forward-looking approach towards increasing corporate environmental responsibility and long-term sustainability.

As an affirmation of CDL's commitment to reduce its carbon footprint, the Company has embarked on neutralising the carbon emissions of its corporate office operations and has recently been certified as a CarbonNeutral® company.

With governments worldwide galvanising action against climate change, CDL is poised at the forefront of change to lead Singapore's built environment into the new era of sustainable development and growth, in support of the Singapore government's announcement to reduce CO₂ emissions by some 16% below 'business as usual' levels by 2020 (subject to a legally binding global agreement reached).

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Earth, this little blue marble hung in space, is the only place in the universe we know of, where there is life.



L. Hunter Lovins
Founder of Natural Capitalism Solutions (NCS)

Natural capitalism – nature’s economy

The two biggest threats we face – climate change and economic meltdown – are linked in both cause and cure, says L. Hunter Lovins, expert in sustainability and founder of NCS. Unless nations, corporations, communities and homeowners move aggressively to implement energy efficiency measures and renewable energy, our economy cannot recover. The business case for climate protection is powerful and proven: cutting carbon delivers one of the highest returns on investment in the whole economy.

Two words define our age: climate and capitalism. People raised on images of limitless possibilities, muscle cars, western superiority in world markets and a rising standard of living watched in shock as the iconic American business, General Motors, melted into bankruptcy in 2008. The economic collapse devastated communities and families in the US, throwing more than 15 million people out of work and sending the unemployment rate to over 25 per cent in cities like Detroit.

Another meltdown, however, poses an even greater threat. In late 2009, the UN warned that even if nations delivered on existing promises to cut greenhouse gas (GHG) emissions, the globe would still warm beyond levels ever experienced by humankind by the end of the century, perhaps sooner.

Critics argue that the science is uncertain. Absolutely. Scientists do not know how bad it may be, or how fast climate chaos will proceed.

But, in a sense, the science is irrelevant. You do not have to believe in the problem to believe in the solution. Even if you are just a profit-maximising capitalist, you should do exactly the same thing as one who is scared to death of climate change because we know how to solve this problem at a profit. And smart companies are doing it.

DuPont was one of the early leaders who ‘got it’, pledging about a decade ago to cut carbon emissions 65 per cent below their 1990 levels by 2010. Ambitious, given

that the US government had refused to ratify the Kyoto protocol that would have committed it to cutting emissions by just seven per cent in the same timeframe.

The company made its announcement in the name of increasing shareholder value and delivered on that promise. The value of DuPont stock increased 340 per cent while the company reduced its global emissions by 67 per cent. DuPont’s programmes have now reduced emissions by 80 per cent below 1990 levels. This saved the company US\$3 billion between 2000 and 2005. The company’s climate protection programme shows that it costs less to implement energy savings measures than it does to buy and burn fuel and emit other gasses. By 2007, DuPont’s efforts to squeeze out waste were saving the company US\$2.2 billion a year. Company profits that year were also US\$2.2 billion. Dupont is profitable because it is protecting the climate.

Another company, ST Microelectronics has pledged to achieve zero net CO₂ emissions and become carbon neutral by 2010 while increasing production 40-fold. The company had no earthly idea how to achieve this, but figuring it out drove their corporate innovation, taking them from number 12 in the world’s chip maker rankings to number six. They estimate that, by the time they’re done, they will have saved about US\$1 billion.

NCS and other sustainability consultants help companies cut waste, transform how they make products, and implement more sustainable ways of doing business. One client left its 6,300 computers and monitors turned on 24/7, driven by urban myths about shortening the life of computers by turning them off. Simply publishing a policy requiring employees to turn computers off when not in use would save it US\$700,000 in the first year. In the US, US\$2.8 billion is wasted each year from leaving unused computers switched on. Such IT costs can represent a quarter of the cost of running a modern office building.

Such savings are free – or better than free – and they exist throughout the economy. It will come as little surprise that American businesses use twice as much

energy to produce a unit of Gross National Product (GNP) as do our competitors in parts of the world like Europe and Asia, where adherence to the Kyoto Protocol drives their competitiveness.

In July 2009, Walmart rolled out its sustainability scorecard to several thousand large suppliers worldwide. The first question was do you measure your carbon footprint? The second question was do you report it to the Carbon Disclosure Project?

Carbon footprinting: a business necessity

Since 2002, the Carbon Disclosure Project (CDP), a UK nonprofit, has surveyed the *Financial Times (FT) 500*, the largest companies in the world. The CDP, which represents 315 global institutional investors with assets totalling US\$64 trillion, almost a third of all institutional investor assets, now receives annual corporate carbon footprint reports from almost 80 per cent of the world's biggest 1,800 companies as ranked by the *FT*. Institutional investors use the CDP database to make investment decisions based on a company's GHG emissions, emission reduction goals and strategies to combat climate change. Companies that do not responsibly manage their carbon footprint are deemed unworthy of investment.

In 2008, Walmart hired the CDP to survey their Chinese suppliers, asking them to report their carbon footprint if they wished to remain a supplier to the world's largest retailer. Globally, Walmart has anywhere between 60,000 and 90,000 suppliers, all of whom are now on notice that meeting the scorecard will be the basis for supplier selection.

When Walmart CEO, Lee Scott, announced the sustainability initiative, he observed that a corporate strategy on reducing GHGs as quickly as possible was simply good business, stating, "It will save money for our customers, make us a more efficient business, and help position us to compete effectively in a carbon-constrained world."

Walmart was one of only two companies in the Dow Jones Industrial Average whose stock price rose in 2008 by 18 per cent – its sustainability efforts were credited, in part, for this.

Programmes to help buildings use less energy and encourage the use of efficient cars, appliances and machines stimulate new manufacturing ventures, increase incomes and generate increased community income. A local government commissioner from Portland, Oregon, stated, "We've found that our climate change policies have been the best economic development strategy we've ever had. Not only are we saving billions of dollars on energy, we are also generating hundreds of new sustainable enterprises as a result."

A 2003 study of the impact of energy efficiency and renewables in Oregon found that, on average, one megawatt saved increases:

1. Annual economic output in Oregon by US\$2.2 million;
2. Wage income in Oregon by US\$684,536 and;
3. Business income in Oregon by US\$125,882.

Each megawatt saved creates an average of 22 new jobs in Oregon. The study found that over 12 megawatts were

saved as a result of Energy Trust programme activities in 2002, with the number growing to 125 average megawatts by 2006.

Small businesses are the economic engine of the US and generate more than half of non-farm private GDP. They represent 99.7 per cent of all employer firms, employing nearly 60 million workers or about half of all private employees. Small businesses consume half the electricity in the US but only about a third have invested in energy efficiency.

NCS's web-based learning tool, 'Solutions at the Speed of Business', shows small businesses how they can benefit from programmes to reduce carbon emissions. For example, a RE/MAX real estate office in Florida implemented a weatherisation programme, caulking windows, and weatherstripping doors. These simple measures cut their need for air-conditioning and put US\$7,900 of savings into their pocket the first year.

As *Business Week* noted, such programmes not only cut direct energy but drive prosperity throughout the economy: "reducing energy waste in US homes, shops, offices, and other buildings must, of necessity, rely on tens of thousands of small concerns that design, make, sell, install, and service energy-efficient appliances, lighting products, heating, air-conditioning, and other equipment."

In California, the world's eighth largest economy, a 2008 study by the University of California found that programmes to reduce energy dependence and increase energy productivity three decades ago directed a greater percentage of the state's consumption to in-state, employment-intensive goods and services whose supply chains largely reside within the state. This created a strong 'multiplier effect' of job creation, generating 1.5 million full-time equivalent (FTE) jobs with a total payroll of over US\$45 billion, saving California consumers over US\$56 billion in energy costs.

Similarly, a University of California study found that achieving 100 per cent of the GHG emission reduction targets mandated by AB 32, the legislation that Republican Governor Schwarzenegger championed to reduce carbon emissions 80 per cent by 2050, would increase the Gross State Product by US\$76 billion, increase real household incomes by US\$48 million, and create as many as 403,000 new efficiency and climate action jobs. These claims are borne out on the ground. Over a seven-month period in 2008, the City of San Francisco created 180 new jobs by enabling 640 residents and enterprises to install 2-megawatt rooftop solar electric systems. The City's SF Energy Watch helped 1,500 businesses and multifamily properties save over US\$5.7 million in energy bills, delivering six megawatts of energy efficiency savings.

Twenty states, representing over two-thirds of the US economy and population, are implementing comprehensive, multi-sector GHG reduction plans. Such programmes will expand employment, income and investment, and contribute to national economic recovery, while achieving net savings of at least US\$85 billion in 2020.

The renewables gold rush

The transition away from fossil fuels to the energy system of the future can happen rapidly. In 2008, the wind industry

added 17 gigawatts of new wind capacity around the world. In 2009, the number jumped to 37 gigawatts. A gigawatt is roughly a nuclear plant sized chunk of electricity.

Solar electricity is nearing competitiveness with new coal plants and is already cheaper than nuclear power. Southern California's independent power producers were building a megawatt a week prior to the economic collapse. Southern California Edison built a 250-megawatt power plant on roofs spread around the county at a price point US\$875 million – uncannily close to the cost of a coal plant recently cancelled in Montana, which would have cost US\$800 million.

In 2007, the US renewable energy and energy efficiency industries generated over US\$1 trillion in sales and created over 9 million jobs, representing substantially more than the 2007 sales of the three largest US corporations combined – Walmart, ExxonMobil and General Motors (US\$905 billion).

While the US debates whether to require power companies and others to generate more electricity from renewable sources, China already has already done so. The China Greentech Initiative reported in September 2009 that China's market for energy efficiency, renewable energy and other green technology could become US\$1 trillion market by 2013.

Calling climate change “one of the most pressing global challenges,” venture capitalist John Doerr predicted that the resulting demand for innovation would create the “mother of all markets.” The UN described it as “[a] gold rush of new investment into renewable power,” concluding that clean energy could provide almost a quarter of the world's electricity by 2030. The European Renewable Energy Council (EREC) was even more optimistic, claiming that half of the world's energy supply could come from renewable energy sources by 2040.

The business case for environmental excellence

Acting to protect the climate can unleash a new energy economy creating the greatest prosperity ever in history. As Sir Nicholas Stern stated, “If we fail to act, it will represent the greatest market failure ever in history.” Businesses and governments can either drive change in ways that allow companies and economies to flourish or they will be forced to respond to resultant crises and hope for the best.

Even in the economic collapse, companies that made a serious commitment to behave in more sustainable ways fared better than their peers in the same industry. A 2007 report from Goldman Sachs, showed that companies that are leaders in environmental, social and good governance policies outperformed the MSCI world index of stocks by 25 per cent since 2005. 72 per cent of these companies outperformed industry peers, were financially healthier, and achieved enduring value. *The Economist* Intelligence Unit repeated these findings and further showed that the worst performing companies in the economy were most likely to have nobody in charge of sustainability.

In 2009, A.T. Kearney released the findings of their report, *Green Winners*, comparing the economic performance of companies with a commitment to sustainability to companies in the same industry without

such a commitment. In 16 out of the 18 industries evaluated, businesses deemed ‘sustainability focused’ outperformed industry peers over three- and six-month periods with differentials of 10 and 15 per cent respectively.

Companies will implement more sustainable processes and procedures or they will risk losing competitiveness in a world that can no longer tolerate unsustainable behaviour.

A 2009 article in *Harvard Business Review* concluded, “Sustainability isn't the burden on bottom lines that many executives believe it to be. In fact, becoming environment-friendly can lower your costs and increase your revenues...In the future, only companies that make sustainability a goal will achieve competitive advantage.” As the corporate world grasps that sustainability is the route to greater profitability, it will drive changes unimaginable by yesterdays activists.

There remains a very important role for government, however. As powerful as markets are, they have real limitations. Markets make good servants, but they're not such good masters, and they're a lousy religion. There's also a very important role for communities of faith in asking whether humans are here to serve as good consumers or whether we have a higher calling. Because, remember, all that markets can do is allocate scarce resources efficiently in the short term. Markets were never intended to take care of grandchildren. That's our job. That is the job of free people coming together and saying, what kind of a world do we want?

Earth, this little blue marble hung in space, is the only place in all the universe we know of where there is life. We are the only ones who can take care of it.

L. Hunter Lovins is President and Founder of Natural NCS, a sustainability consultancy that works with senior decision-makers in business, government and civil society. Her forthcoming book, 'Climate Capitalism' details the business case for climate protection. She has consulted for corporations such as Royal Dutch Shell and WalMart while governmental clients include heads of state. She has coauthored nine books and hundreds of papers on natural capitalism and sustainability. She is a founding Professor of Business at Presidio Graduate School, one of the first accredited programmes offering an MBA in Sustainable Management.

NCS, is a nonprofit that helps companies, communities and countries implement sustainable practices profitably. NCS educates senior decision-makers in business, government and civil society in the principles of sustainability. In partnership with leading thinkers and groups, NCS creates innovative, practical tools and implementation strategies to increase efficiency, environmental practices as well as economic sustainability.

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Energy figures show that bioenergy is now larger than the oil sector in supplying energy to Swedish society.



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Kaj Embrén
Co-founder of Respect

Respect: businesses can lead on sustainability

In a world fighting its way through a deep financial depression and facing an oil crisis, water shortages and climate threats, active leadership on sustainability is required in all types of organisations, writes Kaj Embrén, co-founder of Respect, a business sustainability consultancy based in Sweden.

Investment and proactive incentives in energy efficiency and green technology are now top of the agenda in many countries. Energy figures show that bioenergy is now larger than the oil sector in supplying energy to Swedish society – a positive sign that should spur other nations to minimise their dependency on fossil fuel.

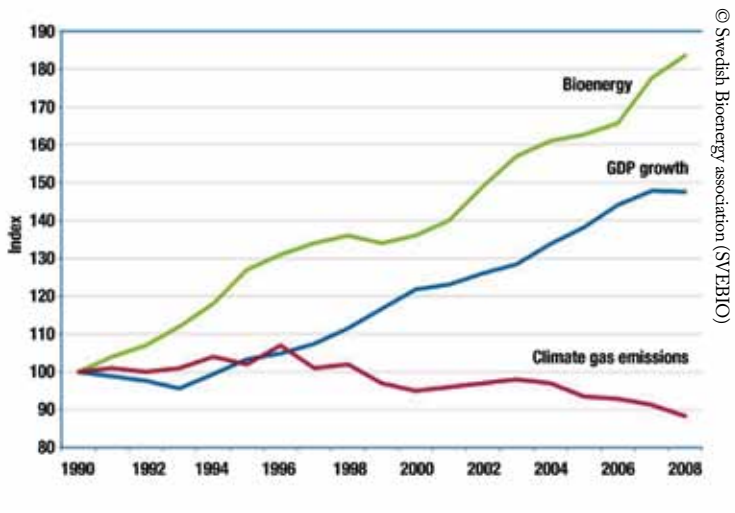
Since 2000 I have had the opportunity of developing ideas and strategies for leadership within the area of sustainable development. It has been a time of inspiration and knowledge seeking. For me, it is about laying the foundations for an increased understanding of the game rules and principles for long-term and systematic work towards sustainability in enterprise.

However, the complexity of the sustainability issue is such that, without a scientific approach to principles and goals, the journey will be exceedingly difficult.

Business leaders who genuinely understand and can define the term ‘sustainability’ and set concrete goals around it are those that will be able to develop the correct tools for monitoring their progress. Strong and clear corporate and political governance are prerequisites in meeting the new challenges now facing society. The dependency on fossil fuels is a complex issue that influences both political and business leaders in their daily work. Investment and incentives for achieving greater energy efficiency and implementing green technology are increasingly national priorities. Here in Sweden we are already seeing promising results from such investment.

We may also see new cost-saving opportunities in the current economic downturn that make compelling financial and environmental sense. Data is emerging from the International Energy Agency (IEA) which spells out the economic case for ending fossil fuel subsidies as governments seek to cut their deficits. In developing countries, these subsidies amounted to US\$557 billion in 2008. By comparison, governments worldwide provided a feeble US\$43–46 billion last year for the development of all renewable energy sources (including biofuels)

Figure 1: Economic growth and carbon reduction.



combined, according to a preliminary analysis published by Bloomberg New Energy Finance in September 2010. Yet, investment in the expansion of (heavily subsidised) corn for ethanol or other crops for so-called 'alternative' fuels cannot legitimately be considered a sustainable solution, as their advocates (usually agribusiness interests) like to claim.

Why on earth are governments pumping tax-payers' money into such foolish expansion of business-as-usual activities when it makes little sense economically, environmentally or socially? Imagine the difference if such money was spent on simultaneously addressing the interlinked problems caused by conventional agriculture, energy and waste management industries. The solutions are known and they should be implemented now.

My work with Respect networks over the past 10 years emphasises the importance of defining the issues for long-term, sustainable business development. We have identified more than 25 issues which in different ways touch upon strategic decision-making for business leaders. Many of them are closely related to the political sector but, as a business leader, there is much that can be done in the global economic market.

Systematically setting principles and goals for sustainability work makes things much easier. A programme called Business Leaders Initiative on Climate Change (BLICC) was established by Respect in 2000 together with leading companies such as IKEA, Interface, Inveco, Maersk, Fortum, McDonalds and DHL. Emissions measurements are a crucial part of the Respect climate change programme. Through BLICC, Respect was actively involved in establishing the greenhouse gas (GHG) Protocol corporate standard in partnership with the World Resources Institute. BLICC piloted the standard and provided key case studies demonstrating its success for businesses.

Carbon calculations enable business leaders to identify their most carbon intensive activities and immediately isolate 'low hanging fruit', where they can make quick and easy carbon reductions.

In 2007, Respect launched a user-friendly programme, Svante, to help companies measure their emissions and

then develop a carbon reduction action plan. The software is aptly named after the Swedish scientist and Nobel Prize winner, Svante Arrhenius, who discovered the greenhouse effect in 1896. The Respect Climate Neutral Programme was the next step to encourage companies to set ambitious emissions reduction goals and today many Swedish companies have started on their journey towards climate neutrality, making their businesses more competitive in the process.

Examples from the latest BLICC report demonstrate the business case for reducing a company's climate impact. It can be achieved cost-effectively and, once started, companies are inspired to continue: every company's 'Road Map' features ambitious plans to further reduce their climate impact.

- MTG Group:** Swedish TV and radio broadcasters, MTG Group, broadcasts television programmes in over 30 countries. New video conferencing equipment installed last year has reduced the company's carbon footprint by slashing the number international flights taken to attend meetings. Through its radio channels, the company is working to influence the behaviour of its listeners. Its 'Go Green' initiative was broadcast to 4 million listeners and presenters discussed everyday climate issues, wrote blogs and organised events in relation to Earth Hour.
- Stena Metall:** Leading Swedish waste and recycling company, Stena Metall, has worked for the last three years to transport more of its scrap by rail rather than by road, managing to cut its carbon emissions from transport by 65 per cent. Each train at full capacity can replace 32 trucks, and the reduction in road transport to date is equivalent to driving around the Earth 150 times.
- Fortum:** Swedish energy company, Fortum, adheres to the principle that every link in the energy chain must be as energy efficient as possible. In the last year, a new flue gas condensation plant has been put into operation. The annual production in the combined heat and power (CHP) power station is 200GWh of heat, while CO₂ emissions are reduced, and the flue gases are purified by a further 50-90 per cent depending on the substance emitted. The amount of district heating produced by the condensation plant is

Figure 2: Share of renewable energy in Sweden's energy use.

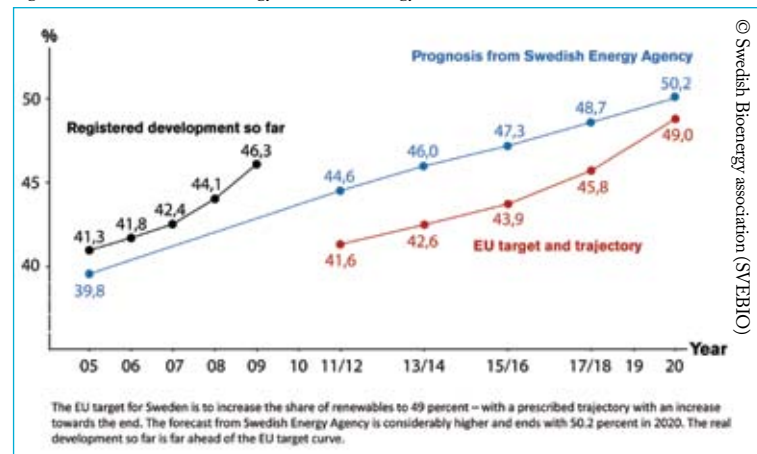
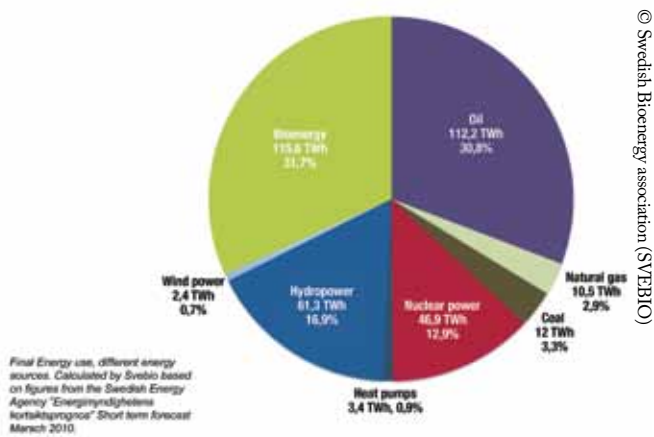


Figure 3: Share of final energy use in Sweden 2009.



almost equal to the total energy consumed by all new customers connected in 2009. The properties connected in 2009 consume 236 GWh annually, resulting in an 80,000-tonne reduction in these customers' CO₂ emissions.

Human Rights was the second business programme jointly established by Respect and the ethical globalisation initiative, Realizing Rights, founded by former UN Commissioner of Human Rights, Mary Robinson. Several well-known companies including, HP, GE, MTV and Barclays Bank were founding members of the group – known as the Business Leaders Initiative on Human Rights (BLIHR) – under the chairmanship of Mary Robinson. One of their initiatives, developed in cooperation with the UN Global Compact, is a practical tool called the Matrix, a guide for integrating human rights into business management.

A study published in the Harvard Business Review entitled *On point – Make Green Profitable*, emphasises the significance of the ability to effect change through strategic decision-making. The complexity of sustainability issues can make it difficult for business leaders to take decisive, strategic action. All too often, failure to effectuate strategic decisions prompts a leader to change their organisation. The findings from five years of working on the study show that well-defined powers of decision-making and well-oiled communication within the organisation are essential if one is to succeed in bringing about positive change. In the complex world of sustainability issues, this proficiency becomes even more important.

Sweden is unique in having a strong state-owned sector with an annual turnover in excess of EUR€50 billion. In 2007, the Swedish government introduced new guidelines requiring state-owned companies to provide sustainability reports in accordance with the Global Reporting Initiative (GRI). This decision, coming from a national government as business owner, was one of the earliest drives towards a regulatory framework for reporting on carbon emissions sustainable development.

In September this year, the first report was published looking at whether the government's new sustainability reporting requirements had changed the behaviour of state-owned companies in relation to the environment. It found that companies which lacked previous experience

of sustainability reporting have gone through a more extensive process of change than those that were already submitting sustainability reports. The results also show that the guidelines contributed mainly to improved procedures for reporting on sustainability issues rather than bringing about far-reaching changes in sustainability activities in practice.

The GRI provides a practical tool for many companies worldwide that need to shape their internal sustainability work. More than 1,300 organisations from 64 countries published a GRI-based sustainability report in 2009. GRI recommends a step-by-step approach in integrating with the day-to-day business activities.

Many of Sweden's biggest organisations have found the GRI useful. Gunnar Olofsson, CEO of Sveaskog, one Sweden's state-owned forestry companies is one. He regards the GRI as a vital aid in developing the company's long term business strategy and brand.

A leader who has not yet formulated goals and a strategy for their organisation within the area of sustainability should, for their own sake, take up these new challenges. If not, they risk damaging their own and their organisation's brand considerably.

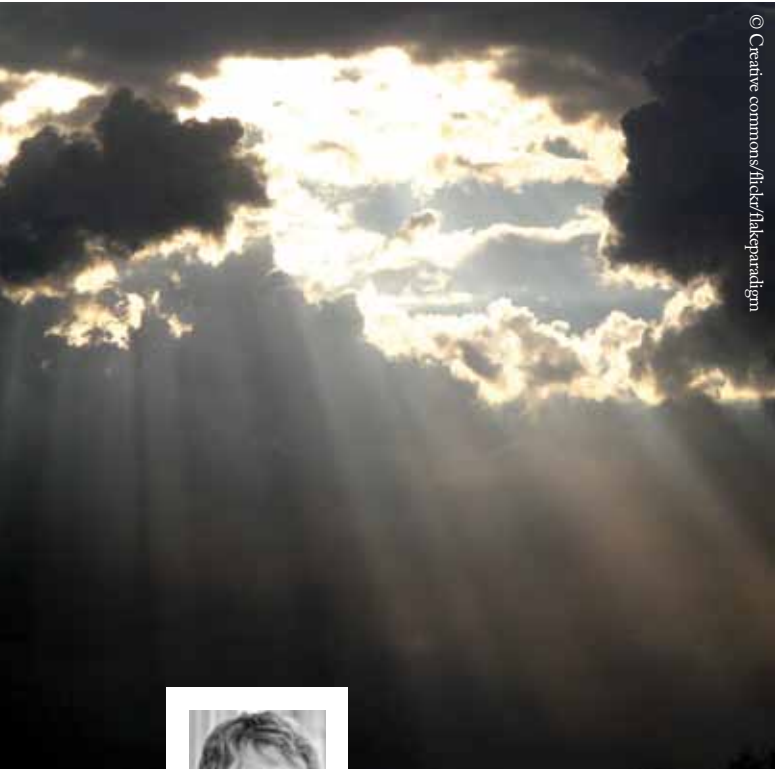
It is an issue for you as a leader, irrespective of the type of organisation you are working in or which position you may have. The time is here to build a sustainable society.

Kaj Embrén is a Swedish business sustainability expert and a co-founder of Respect together with Gordon and Anita Roddick of The Body Shop in 2000. Embrén has established a wide-ranging network of politicians, companies and organisations worldwide eager to help develop strategies and tools for sustainable development in enterprise. Business benefits are always in focus; it is profitable to do it right.

Respect was founded a decade ago by a group of environmentally-minded entrepreneurs, including the widely admired Roddicks. It works with business leaders, championing the issues of environment and sustainability in enterprise. Strong convictions and experience with business ethics are at the heart of Respect and the values-based organisation aims to demonstrate to business the strong connections that exist between profitability, responsible operations and sustainable development.

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Through the fog of the carbon war, a new climate economy is emerging.



Remco Fischer
Programme Manager, UNEP Finance Initiative

Achieving a low-carbon economy requires a private investment revolution

Investment in clean energy systems will have to more than triple current levels in order to revolutionise our energy supply and put us on the path of climate sustainability. As the overwhelming majority of the investment required will have to come from private sector sources, we need a parallel revolution in the way the world's financial markets allocate capital to energy systems, to favour lower carbon intensity and higher energy efficiency projects.

The climate finance gap

Approximately US\$500 billion is required annually as incremental investment until 2030 to reduce the carbon-intensity of energy systems, improve their efficiency and limit GHG concentrations to a maximum of 450 parts per million (ppm), the target governments have set themselves under the Copenhagen Accord. To put this figure into perspective, 2009 saw, after a number of years with unprecedented, double-digit growth rates in sustainable energy investment, a total of US\$162 billion going into sustainable energy companies, technologies and projects; a seven-fold increase over 2002.

Given global energy demand forecasts, much of this investment will have to flow into the developing and emerging world, where according to the World Bank, climate change mitigation investment needs are estimated to be around US\$400 billion per annum, including in the broader energy sector. Of the 2.5 per cent of global

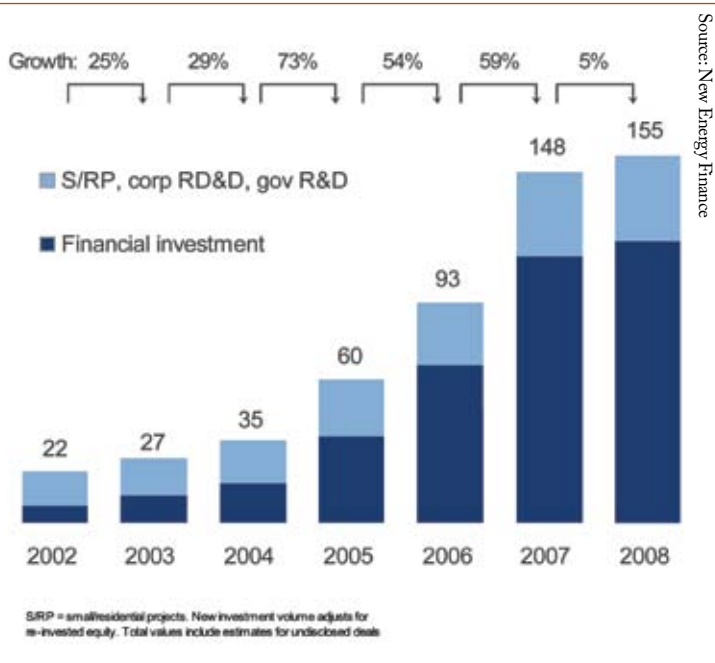
energy demand growth per year forecasted to 2030, 93 per cent is bound to take place in the swiftly growing economies of Latin America, Africa and Asia, where local middle classes continue to emerge and strive for western consumption lifestyles while the 1.5 billion people currently without electricity find their way to the grid.

“The availability of sufficient, appropriate financial resources at the needed scale and in the right place will be key.”

Achieving the complex task of solving the world's energy problem while reducing GHG emissions at magnitudes sufficient to stabilise the climate will require what the International Energy Agency (IEA) has termed a true revolution in the way mankind sources, transforms and consumes energy. The wide body of analysis available on the financing of climate change mitigation points towards two facts of utmost importance to the way in which societies respond to climate change:

- 85 per cent of the total investment needed for climate change mitigation across sectors and regions will have to come from private sector sources.

Figure 1: New investment in sustainable energy, 2002-2008.



- Over 70 per cent of total investment in sustainable energy to date has been financed by third-party entities, meaning external investors and lenders which include financial services sector, the capital markets and third-party investors such as venture capitalists (see Figure 1).

The availability of sufficient, appropriate financial resources at the needed scale and in the right place will be key. As the overwhelming majority of these resources will only be available from private as well as third-party sources, it becomes clear that not only a revolution in the energy sector is needed. A parallel revolution is needed in the way the world's financial markets allocate capital to energy-supply and demand: bankers, investors, financial analysts, and fund managers will have to be at the heart

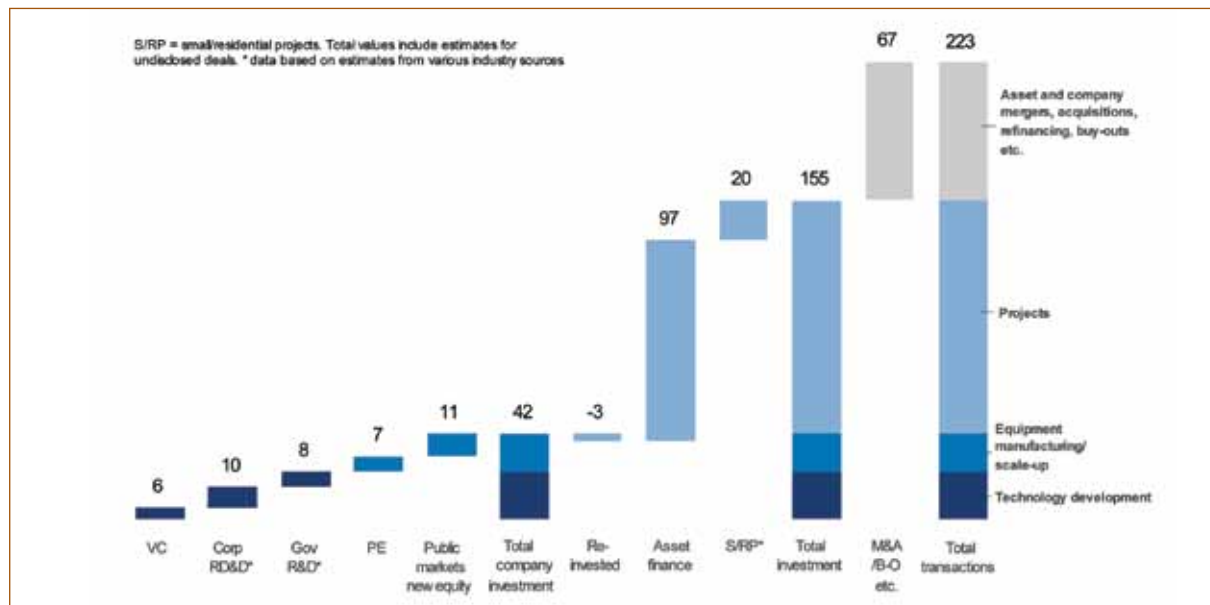
of the revolutionary transition of energy systems towards lower carbon-intensity and higher energy-efficiency.

Increasing private financial flows at the needed scale will require financial practitioners of all types to shift perceptions regarding the attractiveness of sustainable energy technologies, projects and companies, and it is unlikely that a shift of this size will come entirely from philanthropic and corporate social responsibility (CSR) motivations. The financial services sector is a heterogeneous group of institutions, mindsets and procedures. But fundamental changes in the way capital is reallocated to technologies, companies and projects – at the scale required – will have to be triggered by one of two variables that essentially drive mainstream financial decision-making, namely risk and return.

Increasing private financial flows at the needed scale will require financial practitioners of all types to shift perceptions regarding the attractiveness of sustainable energy technologies, projects and companies.

Financial return and risk are not stand-alone categories however: lenders and investors want to make a return proportional to the level of risk they undertake. Sustainable energy investment will hence become more likely and frequent if perceived levels of risk are reduced for a given level of return, or returns are increased for any given level of risk. The growth throughout the last decade of sustainable energy investment has been triggered

Figure 2: Global transactions in sustainable energy, 2008, US\$ billion, per source of finance.



by such risk–return shifts. However, this positive track record has only been witnessed in a limited number of jurisdictions and technology types and, despite rampant growth in investment flows, absolute figures remain insufficient compared to what is needed.

The ultimate question is what forces and/or external drivers will trigger the shifts needed in the way the finance sector views the sustainable energy space through its risk and return lens? And what barriers stand in the way?

Enabling the finance revolution

Enabling the finance revolution for a low-carbon energy future is, in principle, simple and it is already happening around the world, albeit at a modest scale. The risk–return profile of sustainable energy relative to carbon-intensive energy is even improving, slowly but steadily, without any explicit government support, due to a number of ‘naturally’ occurring developments:

- **Resource economics:** increasing fossil fuel demand and the resulting supply constraints, will lead to ongoing price increases in the medium to long term. The price of oil in 2009, for instance, was US\$59.21 per barrel and is predicted to be US\$135.22 per barrel in 2035, an increase of 125 per cent. The price of natural gas was US\$3.33 per 1,000 cubic feet in 2009 and is predicted to be US\$8.06 in 2035, an increase of 142 per cent.
- **Innovation economics:** ongoing technological innovation is making sustainable energy technologies competitive with and commercially superior to conventional technologies. The average price for photovoltaic modules, for instance, excluding installation and other systemic costs, has fallen from levels of roughly US\$100 per Watt of installed capacity in 1975 to US\$4 per Watt in 2006. In the US, the price for electricity from wind has dropped from US\$0.30 per kWh to US\$0.05 per kWh.
- **Green consumerism as a macro market trend:** sustainability is considered by many commentators to be one of the most fundamental macro–trends in consumer markets, with green products and services traded at a premium: technology developers, project developers, power generators, grid operators and utilities with green credentials will increasingly be able to capitalise on this macro–trend to reap above-average prices. In Germany, for instance, more than one million households purchased around 2.8 terawatt-hours (TWh) of green power in 2007 and more than 60,000 commercial customers purchased another 1.3 TWh. Estimates for 2008 show household purchases more than doubled 2007 levels, at 6.6 TWh.

Unfortunately these trends are still too weak to drive and accelerate the scale-up of low carbon investment towards the US\$500 billion needed. Only policymakers, regulators and the international climate change regime can enable the finance revolution. Such approaches can include:

- **A price on carbon driving the internalisation of the environmental costs of GHG emissions:** by forcing the internalisation of environmental costs, a meaningful

carbon price creates a level playing field between sustainable and conventional energy options. Under a cap and trade system or an international crediting mechanism, a price on carbon can open new revenue streams for sustainable energy projects. At present, operative emissions trading schemes can be found only in the EU-27, a few states in the US and New South Wales in Australia, while carbon tax schemes are found only in two US states, eight European countries and two Canadian states.

- **Loan guarantees and other public finance mechanisms** improve the economics of a financial transaction itself rather than of the underlying investment asset. A loan guarantee, for instance, considerably reduces counterparty risk for any given level of return (interest) without influencing the underlying profile and viability of the actual project. An example is the Currency Exchange Fund (TCX) that hedges local currency risks with swap products for those investing in developing countries. There exists no similar fund aimed at reducing risks explicitly in the sustainable energy space.

“Ongoing technological innovation is making sustainable energy technologies competitive with and commercially superior to conventional technologies.”

- **Tax incentives** will decrease the overall tax burden of developing or deploying sustainable energy technologies. A decreased tax burden will lead to higher profits and increased investment returns but in 2005 only 37 countries had implemented tax-based incentives for sustainable energy options.
- **Renewable energy production incentives and feed-in tariffs** can considerably enhance the risk–return profile of sustainable energy projects:
 - (i) Providing a price premium for renewable energy compensates for the cost disadvantages of clean energy sources, enhancing the profits of projects and returns on investment
 - (ii) Feed-in tariffs as well as production incentives are mostly offered at a predetermined height and over a predetermined number of years and provide medium- to long-term certainty on prices and revenues. Market risk is therefore entirely mitigated while prices for conventional energy remain volatile.

There are many approaches that legislators and regulators can follow in unlocking markets and private finance for decarbonising energy systems, including phasing out the massive flows of fossil fuel subsidies and decoupling the profitability of power generators and utilities from electricity volumes sold.

Policy transparency, longevity and certainty

The actual types of policy design and instruments appear to be of only secondary importance from an investor's perspective: according to Mark Fulton, managing director of Climate Investment Research at Deutsche Bank and co-chair of UNEP Finance Initiative's Climate Change Working Group, it is crucial that policies are in place, but they are not much use unless investors and financial intermediaries can fully rely on them in the medium to long term.

Looking around the world, there are many examples of countries embodying the principles of TLC in their climate and energy policies.

Of primary importance for investors and lenders is that policy frameworks and instruments are governed by the principles of transparency, longevity and certainty (TLC). Only if these principles are featured in government action on carbon emissions, renewable energy and energy efficiency, will investors deploy capital. Investors need transparency in policies to create understanding and a level-playing field. Longevity means policy has to match the timeframe of the investment and stay the course. Certainty refers to knowing that incentives are financeable and can be trusted in the financial return calculation and are likely to be maintained over the course of the investment. In economic terms, TLC should result in a lower cost of capital for projects while still delivering a fair and market-related return to capital.

Who is winning the global race for clean energy investment?

This year has been a tough one for the global climate agenda. Policy pessimism after Copenhagen has been compounded by (largely unfounded) doubts over climate science along with governments backtracking on commitments in key countries. But, according to Nick Robins, Head of the HSBC Climate Change Centre of Excellence and Co-Chair of UNEP FI's Climate Change Working Group, "through the fog of the carbon war, a new climate economy is emerging and the global race for attracting investment for a clean and innovative energy economy continues, driven as much by resource scarcity and industrial innovation as by the raw realities of global warming."

New research by HSBC shows that the future size of the 'climate economy' – which encompasses products and services related to the generation and distribution of low-carbon power as well as energy efficiency improvements in buildings, industry and transport – is likely to double

in size from US\$740 billion in 2009 to between US\$1.5 and US\$2.7 trillion in 2020. It also shows that the fastest growth is likely to occur in emerging markets, notably China and India, with the low-carbon energy market in both countries offering average yearly growth rates of 14 per cent. This delivers an important shuffling of the pack in terms of market share. The EU remains the largest market but its share falls from 33 to 28 per cent by 2020. China grows from 17 to 24 per cent, pushing the US into third place. India also rises and becomes the fourth largest market, with Japan falling to fifth. Clearly, these growth rates are strongly influenced by the underlying economic dynamism in Asia – but they also reflect the growing strength of policy frameworks in these countries with regards to transparency, longevity and certainty. The analysis suggests that just two regions – the EU and China – already make up half the global market and this proportion is projected to grow further by 2020.

Looking around the world, there are many examples of countries embodying the principles of TLC in their climate and energy policies and achieving capital deployment. Germany has established a feed-in tariff (FiT) regime that supports the EU mandated goal of 20 per cent renewable energy as a share of electricity by 2020. Germany's FiT system embodies TLC for investors: not only does it provide standardised, transparent contracts with up to 20 years of longevity, with guaranteed payment streams; it also ensures the 'right pricing' for electricity consumers, through a tariff digression over time to match all reductions in technology costs, with an end target of grid parity with fossil fuels. The results speak for themselves: the creation of 300,000 jobs; renewable energy at a 13 per cent share of electricity and rising; a rapid fall in solar Photovoltaic costs leading to lower tariffs on the digression schedule with a forecast of grid parity by 2013.

Remco Fischer is Programme Manager for UNEP FI where he manages the Initiative's activities on climate change and co-ordinates the UNEP FI Climate Change Working Group (CCWG). Prior to joining UNEP FI, he worked as an investment management assistant, designing structured deals in infrastructure project finance, predominantly for renewables. He holds British, German and Spanish degrees in Business Administration, Finance and International Economics.

UNEP FI is a unique global partnership between UNEP and the financial sector. Over 190 institutions, including banks, insurers and fund managers, work with UNEP to develop and promote linkages between sustainability and financial performance and to realise the adoption of best environmental and sustainability practice.

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Shipping has a potential to become a sector that can aid the development of a low-carbon future.



Jacob A. Sterling
Head of Climate and Environment, Maersk Line



Shipping can help tackle global climate change

The shipping sector must become a 'solutions sector' in addressing the challenges of climate change, says Jacob A. Sterling, head of Climate and Environment for global shipping company, Maersk Line. Shipping has real potential in reducing the carbon footprint of the world's transported goods, providing reliable, low-carbon alternative to air freight and road transport.

It is well established that we need to act now if we want to keep the costs of addressing climate change under control. Yet, with no international agreement, climate change action is left as a vague responsibility for all – or an urgent responsibility for nobody.

Shipping should have CO₂ regulation

Shipping, like aviation, is not part of the Kyoto Protocol but its inclusion in a new global agreement of climate change was on the agenda at COP15 in Copenhagen. With a CO₂ footprint greater than the total emissions of Germany, shipping should be covered by an international climate change agreement.

Maersk Line supports the International Maritime Organization (IMO) in taking a lead on the development of CO₂ regulations for shipping and, despite the unsuccessful COP15, the company hoped the IMO would make rapid progress on the issue.

The latest meetings in the IMO's Maritime Environmental Protection Committee (MEPC) have not been promising. Some countries clearly feel that the pressure is no longer there to deliver an agreement, others are waiting for UN Framework Convention on Climate Change (UNFCCC) to set the overall direction and do not want to close any deals for particular sectors, such as shipping, before this happens.

It is a disappointing waiting game for two reasons:

1. There is significant potential for improving efficiency in shipping: Maersk Line has set a voluntary target of reducing

its CO₂ emissions by 25 per cent per container moved by 2020, compared to 2007 levels, and has already achieved about half of that through the introduction of slow steaming and other operational measures.

“The new vessels that Maersk Line will bring into service in 2011 demonstrate more than 20 per cent efficiency improvement over similar new-build vessels.”

The new vessels that Maersk Line will bring into service in 2011 demonstrate more than 20 per cent efficiency improvement over similar new-build vessels where there was less focus on fuel efficiency in the design phase.

2. Shipping risks being seen as a laggard: As there is no regulation ensuring a more CO₂-efficient shipping industry, the sector risks being seen as a laggard in energy efficiency, despite its very real potential to be a 'solutions sector'. Shipping can facilitate the development of a low-carbon economy through its transportation services.

Therefore, we still strongly urge the IMO and the UNFCCC to remove the barriers and secure a global, flag-neutral agreement on climate change mitigation for shipping. Such a deal will almost surely increase the cost of operating a shipping line but, as long as the agreement is designed to ensure a level playing field for all, we would welcome it.

Climate change: a challenge and an opportunity for shipping

Addressing climate change is a huge challenge – but one of the reasons for the lack of success in reaching a global agreement is the sole emphasis on establishing limits and enforcing reductions. More focus should be put on the industries and solutions that need to grow for the world to succeed in reaching a prosperous low-carbon future.

Wind turbines and solar panels are clearly part of the solution. So are enzymes that can reduce the use of chemicals and energy in various production processes. Information and communication technology can reduce the need for air transport. Equally, shipping can develop into a 'solutions sector' that can help bring about a low-carbon economy.

Already today, shipping is by far the most energy-efficient way to transport goods. For example, shipping a pair of shoes from China to Northern Europe would emit the same amount of CO₂ as driving 2km in a regular car. And when cargo is converted from air freight to shipping, the associated CO₂ emissions are typically reduced by 90 per cent or more.

“What matters is not the distance the food has travelled, but the total CO₂ emitted from production and transport of the products.”

This means that the more shipping grows, taking a bigger share of the freight currently transported by road or air, the greater the reduction in global CO₂ emissions. A recent report from the Low-Carbon Leaders Project, which is supported by UN Global Compact and the WWF, outlined the huge potential for such 'modal switches' in freight transport and recommended that policymakers broaden the current narrow focus on reducing 'food miles' to discussing how to best promote modal switches to more efficient forms of transportation.

Maersk Line is keen to take increasing market shares from other modes of transportation. It is part of our business strategy and we have numerous innovation projects to make it happen. Together with the company Aqualife, we have developed a method for transporting live lobsters by sea in special containers. Normally live lobsters are transported by air and the switch to shipping significantly cuts CO₂ emissions. Even the transport of cut flowers can be converted from air to shipping if flower traders are open to adjusting their businesses to the somewhat longer delivery times.

Shipping can help 'move the sun'

Some may argue that it would still be better to stop global trade altogether and produce goods locally to avoid the sizeable emissions from transport.

The *Low-Carbon Leaders* report, however, has a different view. It recommends that policymakers shift

While shipping is the most efficient mode of transportation, global regulation is needed to ensure efficiency improvements in the industry.



their perspective from how transport should be reduced, to focusing on how the services needed in society can be provided with the lowest possible CO₂ emissions.

One crucial service, for example, is the provision of food. The report argues that, given the greater solar inflow around the equator, it would make sense to increase food production in these regions as there is greater potential for high crop yields, and then move the food to the point of consumption in a low-carbon fashion. The authors call this concept 'moving the sun'. What matters is not the distance the food has travelled, but the total CO₂ emitted from production and transport of the products.

We think this makes a lot of sense, and we are excited about the role it creates for shipping and for Maersk Line. With our energy-efficient refrigerated containers, we are already providing transportation services for food producers around the world: this is certainly a business that we aim to grow in the future.

We will continue to strive for low-carbon solutions in shipping and to find innovative ways to facilitate the modal shift from air and road to sea for the world's freight, regardless of failures to establish any global CO₂ regulation for the sector so far. We hope this will bring inspiration to those policymakers working hard to reach a global agreement on climate change.

Jacob A. Sterling is head of climate and environment for Maersk Line. He is leading the company's efforts to reduce CO₂ emissions and other environmental impacts, differentiating the company in the market based on its environmental performance. Previously, he worked in WWF and he holds a M.Sc. in biology with a focus on environmental conservation and natural resource management.

Maersk Line is a world leader in shipping, serving customers and transporting containers all over the globe. Its fleet comprises more than 500 container ships and has offices in over 125 countries. Maersk Line made around 40,000 port calls in 2009 – roughly one every 10 minutes.

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Beautiful small island states are at risk from climate change.



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An equitable governance framework for climate finance



Neil Bird
Research Fellow, Overseas Development
Institute (ODI), UK

Channelling new financial resources quickly to countries in need is a top priority for all parties under the UN Framework Convention on Climate Change (UNFCCC). Yet despite the pledges made at Copenhagen, little attention has been given to the principles of how this new climate finance should be mobilised, administered and disbursed. Adopting an explicit framework of principles already embedded within the international negotiations would help track and monitor this funding. In this way, trust could be restored in the ability of developed countries to help meet the needs of developing countries, as the latter respond to the challenges set by climate change on their sustainable development.

Considerable emphasis is placed on tackling climate change, recognising the vulnerability of small island states and least developed countries in particular. Following the uncertain outcome of the COP meeting, 2010 is a critical year to secure progress on an international response that is both adequate to the needs of the poorest countries and equitable in the sharing of responsibility of action to remain within a global 2°C temperature rise.

The commitment to provide new finance in support of climate change actions in developing countries was one of the few areas where tangible progress was made at the Copenhagen meeting. Securing a system that manages these new financial flows is an immediate challenge for the international community.

Estimating global needs for climate finance

Some understanding of the scale of the overall finance required is necessary to gauge whether proposed action is commensurate to need. However, all current estimates employ a global, top-down approach. There is huge

uncertainty in this method, which can be seen in the widely differing figures of alternative assessments.

As one example, the European Commission estimates that developing countries will need €5-7 billion from international public sources per year between 2010 and 2012 (for fast start financing), €9-13 billion in 2013, building up to a level between €22 and €50 billion per year by 2020. These estimates are based on the assumption that developed countries commit to emission reduction targets of 30 per cent below the 1990 baseline in aggregate (something that has yet to be achieved) and that developing countries limit the growth of their emissions to roughly 15-30 per cent below business as usual by 2020. With less ambitious emission reduction pledges by developed countries, the need for international public finance may more than double, rising to €120 billion per annum in 2020.

Principles of climate finance under the UNFCCC

As new funding mechanisms to tackle climate change have developed, a number of principles have been proposed to assess their relative worth. However, there has been little emphasis on how these principles might fit together in a coherent framework by which compliance with the principles could be assessed. Such a framework may usefully be constructed by linking the three sequential phases that relate to the mobilisation, administration and disbursement of funding (Table 1). The following sections examine the principles and criteria relevant for each of these three phases.

Fund mobilisation

In terms of resource mobilisation, there is increasing consensus that the principle that 'the polluter pays' should apply to national contributions towards the global costs of climate change, and that the level of funding should

Table 1. Principles and criteria for climate change funding

Phases in delivery of funding	Principle	Criteria
Mobilisation – funds raised	The polluter pays	Financial contributions are relative to the quantity of are how emissions
	Respective capability	Financial contributions are relative to national wealth
	Additionality	Funds are more than existing aid commitments
	Adequacy	Funds generated are equal to the scale of the task of maintaining global temperature rise to below 2°C
	Predictability	Funding is known and secure over a multi-year funding cycle
Administration – how funds are managed	Transparency	Funding structure, financial data, decision-making processes and decisions are put in the public domain
	Accountability	Fund management reports to a recognised authority
	Equitable representation	There is broad representation of all stakeholders with regard to the decision-making of the fund
Disbursement – how funds are spent	National ownership	Recipient countries exercise leadership over their climate change policies and strategies
	Timeliness	Funding is delivered when required
	Appropriateness	The funding modality does not result in additional burdens for the recipient
	Access for the most vulnerable	Credit, resources and technologies are made available to vulnerable groups

be relative to national wealth ('respective capabilities'). In addition, developed countries assumed an obligation to provide new and additional financial resources to meet 'the agreed full costs by developing countries Parties' under Article 4 of the UNFCCC. It was also acknowledged that the implementation of these commitments should take into account the need for adequacy and predictability in the flow of funds. This was subsequently re-emphasised under Paragraph 1 (e) of the Bali Action Plan and can therefore be taken as a core commitment of developed countries under the climate change convention. Some of the issues that remain to be addressed to ensure clarity over the implementation of these principles include:

The polluter pays – while it is acknowledged that the amount pledged should relate to the level of greenhouse gas emissions of the countries concerned, whether this includes 'historic' emissions is uncertain, in part because of data constraints. The timescale over which emissions are measured matters in determining national contributions and is therefore the subject of intense political negotiation. Unfortunately, historic data are lacking and limit how far back in time reliable estimates can be made. A pragmatic performance indicator could be developed using 1990 as the base year, as comparable national estimates began to be collated from this date.

Respective capability – contributions should relate to a measure of national wealth. However, major changes are underway in countries' relative economic performance, with strong comparative growth occurring in countries such as China, Brazil and India at a time when many developed country economies have experienced a decline in the growth of national wealth. The choice of the reference year for any international comparison is therefore another key concern. One approach would be to use the same period of time for emissions and

national wealth estimates, so as to derive indicators with a common time period.

New and additional – funding should be additional to existing official development assistance (ODA) commitments to avoid the displacement of financial flows that are needed for development. This principle has been the subject of much discussion, yet the statistics collected do not appear to allow for the separation of existing ODA expenditure from climate finance classified as ODA, and hence a suitable criterion (and performance indicator) remains elusive. The possibility of labelling national contributions as being non-ODA transfers has not achieved traction with any of the major contributors, although this would provide a performance indicator that could be readily assessed.

Adequate – this is presently understood to mean the level of funding required to keep within a global 2°C temperature increase scenario. However, at the COP meeting in Copenhagen there were strong calls from some countries that the global temperature rise target should be reduced to 1.5°C, which would have a significant impact on the level of funding needed. Yet, as described above, the estimate of need remains an area of considerable uncertainty. To make progress may require moving away from the present global, top-down approach and replacing it with national estimates of need, as documented within national climate change strategies.

Predictable – financial flows should be sustainable over the medium term to allow national investment programmes to plan, scale up and implement priority actions for adaptation and mitigation. However, it is unlikely that public finance can be secured over more than a few years, due to national treasury rules within contributing countries. An indicator of performance could consider the proportion of funding pledged over successively longer time periods.

Fund administration

Three principles can be identified that underpin the management of climate funds. The first two of these have featured strongly in parallel debates over how development co-operation funds should be administered and relate to the high standards of probity expected over public finances in democratic states: that such funding should be administered in a transparent and accountable manner. The third principle, that of equitable representation, can be characterised by the need for a broad representation of all stakeholders on the fund decision-making body. This represents a significant departure from development co-operation norms, where a donor-recipient relationship has applied. Much of the early discussion surrounding the Kyoto Protocol Adaptation Fund (AF) and the World Bank-administered Climate Investment Funds (CIFs) centred on this point. In both cases, the outcome was novel; with regards to the CIFs, decision-making is undertaken by trust fund committees, which have equal representation from developed and developing countries. Similarly balanced representation from major constituencies occurs on the AF Board. For all three principles, however, specific performance indicators have yet to emerge. Who will be responsible for assessing such performance is also unclear.

Fund disbursement

Much less attention has been given to the principles that underpin how climate finance should be disbursed. Yet this is a key stage of the overall financial architecture that will determine whether climate finance will be effective, efficient and equitable. Four principles of action to be considered are:

National ownership – as measured by the extent to which recipient countries exercise leadership over their climate change policies and strategies. This principle is mirrored in the Paris Declaration on Aid Effectiveness, reflecting the centrality of self determination in all international relations. It implies that countries determine their own spending needs based on national strategies. Once the appropriate definition of a national climate change strategy is agreed upon this should become a reasonably straightforward performance indicator.

Timeliness – the timing of funding did not feature as an implementation principle in the Paris Declaration, but was subsumed within the principle of alignment with national strategies, institutions and procedures. However, it may be worth elevating this issue to the principle level for climate finance as the timing of action is becoming ever more important as the science of climate change advances our understanding of what needs to be done.

Appropriateness – there is a consensus that the funding modality should not result in additional burdens for the recipient country, but as yet little agreement over the appropriate performance indicator by which this could be measured. Civil society has raised concerns over climate finance delivered as loans, not grants, but some countries hold firmly to the view that loan finance may be appropriate under specific national conditions, depending upon what is being financed. A more nuanced indicator is required.

Access for the most vulnerable – equity is a strong underlying principle of international climate funding. Climate finance should be distributed in an equitable manner, responding to the needs of all countries and taking into account the social and economic reality of the recipients. This will require that credit, resources and technologies are made available to vulnerable groups. How this can be measured in an explicit and unambiguous way has yet to be determined. At the national level the relative allocation of international funds between middle income and low income countries would be an early indicator of whether the equity principle was being upheld.

What next?

A key concern should be the emphasis given to matching international financial resources with defined needs, as identified through National Communications, National Adaptation Programmes of Action and now Nationally Appropriate Mitigation Actions. In this context, something can be learned from the earlier experience of the development co-operation relationship. Prior to the Paris Declaration on Aid Effectiveness, national ownership over the development process was a principle of engagement that donors at times ignored. What may be needed now is a similar 'Paris Declaration' for the provision of climate finance (while recognising the very different relationship that exists between North and South over climate change compared to development co-operation). The value of the Paris Declaration was that it drilled down, going beyond vague statements of principle to agree explicit criteria and indicators by which progress could be impartially monitored by all parties.

Over the immediate period up to 2012 there are a number of choices to make with regard to climate finance: whether to continue the focus on fund mobilisation or to direct more effort at the design of optimal disbursement channels within recipient countries; whether to continue with a range of funding initiatives or to acknowledge redundancy or competition and address these; and how to work with other global interests, including the United States and China, in order to keep the UNFCCC process alive and ensure that pledges on climate finance are honoured. Climate finance needs to become more effective, efficient and equitable.

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The ODI is the UK's leading independent think-tank on international development and humanitarian issues. Its mission is to inspire and inform policy and practice that lead to the reduction of poverty, the alleviation of suffering and the achievement of sustainable livelihoods in developing countries.

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There is projected to be a third more people on the planet by 2050, mostly located in urban areas.



Matthew Bateson
Director of Energy & Climate for the World Business Council
for Sustainable Development (WBCSD)

The 'green race' is on

Disappointment over the lack of an international deal for reducing global emissions at Copenhagen has perhaps obscured a trend with tremendous growth potential: companies and countries have entered a 'green race' to become world leaders in developing clean energy and climate-friendly industries.

This has begun not a moment too soon. Explosive population growth expected in the next 40 years will lead to a world that is increasingly carbon and resource constrained. The developing world is expanding, creating an enormous demand for resources to build infrastructure. The wise use of resources today is critical: tomorrow it will be too late. The best and quickest way to decarbonise our economies will be for governments to put in place measures to unleash private investment.

There have been ambitious national-level efforts to attract clean energy investment. The list of countries is lengthening and the rankings are changing fast. According to an Ernst & Young index that assesses country attractiveness for renewable energy investment, the US has lost its top slot to China – a position it has held since 2006 – while Japan, New Zealand and Australia have all moved up a few places.

Companies and countries are also starting to value their water, one of the single most important engines of economic growth and stability.

The race to decarbonise

The current global economic downturn has mostly hit developed countries yet the world is expected to see tremendous growth over the next 40 years to 2050, mostly in developing countries. There is projected to be

at least a third more people on the planet by then, most of them located in urban centres in emerging markets. Therefore the focus will be on improving the quality of life – to deliver clean energy, clean water, paved roads and more and better schools.

This enormous expansion – and consequent faster economic growth – will push up demand for resources which, if poorly managed, will lead to greater pollution. In short, the massive wave of infrastructure necessary to improve the livelihoods of literally billions of new citizens, mostly in developing countries, will lead to a world that is resource constrained. Running parallel, meanwhile, there will be the challenge to decarbonise the energy systems and economies of developed countries.

“Business is the main partner for governments in building a low carbon future. In developing countries, private sector investment in clean energy in 2009 was treble that of public finance.”

The twin challenges in the developed and developing worlds will put tremendous pressure on increasingly limited resources.

Private sector is paramount

It is a simple truth that applies as much for clean energy as it does for industrial development more broadly: the private sector is the world's main source of technology, financial flows and investment. For example, the private sector is responsible for 85 per cent of energy investment.

Business, is the main partner for governments in building a low carbon future. In developing countries, private sector investment in clean energy in 2009 was treble that of public finance. While estimates of investment needs for mitigation vary substantially, one authoritative assessment by the International Energy Agency (IEA) estimates that we must invest US\$2 trillion a year to keep global temperature increases within 'safe' limits. Most of this funding must be generated nationally.

What is more, the UN Framework Convention on Climate Change (UNFCCC) estimates 86 per cent of this money will come from private sector flows in the form of foreign direct investment by companies. The private sector is an important part of the solution.

Picking up the pace

Although no comprehensive accounting exists that tallies global investment in green growth, it is clear that we are falling far short of the US\$2 trillion investment needed per year. To accelerate the low-carbon transition, the world must take the following measures to spur greater private investment:

Grow domestic demand: To stay competitive, countries must transform their home markets to stimulate domestic demand for low-carbon solutions and to build scale and export capability.

Business engagement at international level: It is vital for governments to engage business at a much deeper level, particularly in the international climate framework negotiations, and to look to business as the main driver of clean investments. By doing so, governments can leverage their investments up to 15-fold.

“Business often invests for the long term, especially in large, billion-dollar infrastructure projects and needs long-term green policies to match this.”

Long-term government incentives: Investing in clean energy and mitigation technologies by business requires policies that encourage stable, long-term financial flows. These policies must be at national, bilateral, multilateral and possibly at a global level. Business often invests for the long term, especially in large, billion-dollar infrastructure projects and needs long-term green policies to match this. Legislation is an important element in what makes a country an attractive – or unattractive – place to invest in clean technology. A recent demonstration of this was the

statement by Deutsche Bank that it would focus its US\$7 billion green investment fund outside the US after the US failed to pass legislation that would put a price on carbon.

Address the obstacles to clean tech investment in developing countries: So far, many developing countries have failed to unlock sufficient private investment because a number of specific risks associated with clean energy have not been addressed.

Funding and subsidies for clean energy: Governments must put in place measures to reduce investment risks, such as combined funding of projects, outright subsidies and/or risk guarantees. Greater international financial support will be needed to increase mitigation measures in developing countries.

New public private partnership models: Given the scale of investment required, neither the private sector nor the public sector can address the decarbonisation challenge alone. New, straightforward public private partnership models must be developed that can drive investment into tried-and-tested green technology.

Individual governments have started to implement incentives to stimulate investments. At the same time, business continues to seek opportunities to invest in and develop low-carbon products. However, the negotiations in Cancun are still being counted on to provide the greatest incentive. For business, the market will always provide the most effective stimulus. Carbon needs to be valued appropriately and a global market driver needs to be created for clean, low-carbon investment.

Matthew Bateson is Director of Energy & Climate for the WBCSD, one of four key areas of focus for the Council. Prior to his appointment in 2008, he worked for Shell for over 14 years, in Finance and latterly in Corporate Affairs. He also worked in the company's International Government Relations department, handling government relations in Nigeria and those pertaining to Shell's Canadian oil sands development.

The WBCSD is a CEO-led, global association of some 200 companies. It provides a platform for companies to explore sustainable development, share knowledge, experiences and best practice, and to advocate business positions on these issues in a variety of forums, working with governments, non-governmental and intergovernmental organisations. Members are drawn from more than 30 countries and 20 major industrial sectors. The WBCSD also benefits from a global network of some 60 national and regional business councils and regional partners.

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Green growth: incorporating sustainability at the heart of company strategy is delivering impressive results.



Image courtesy of BMW



Emma Howard Boyd
Director of Jupiter Asset Management

Low-carbon world-beaters:

Energy-efficient solutions are growth drivers for blue-chips

Given the urgency required in meeting ambitious carbon reduction targets, we should be enthused and emboldened to see established, large-cap companies making it their business to facilitate the transition to a low-carbon economy, and reaping the rewards from doing so, says Emma Howard Boyd, director of Jupiter Asset Management.

A strong business won't stand still as the world around it changes. A glance at the most enduring and established companies reveals a common culture of continuous innovation and adaptation in response to anticipated risks and opportunities. In this respect, efforts to decarbonise and yet grow our economy represent an exciting long-term opportunity for those businesses that can successfully market low-carbon solutions.

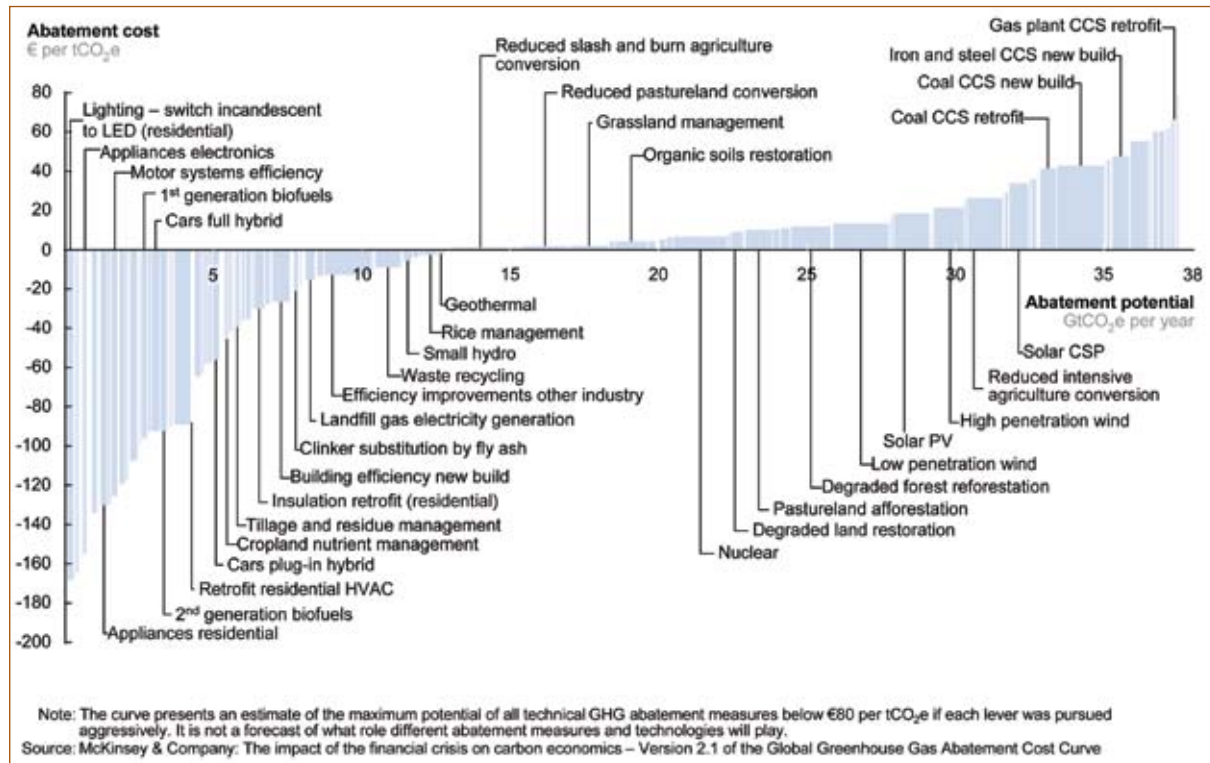
Indeed, even in a deeply challenging economic environment, recent years have been characterised by an increasing flow of corporate low-carbon growth stories, not least from established businesses sensing a burgeoning market now and in the future. The

presence of large-caps within this bracket is especially notable, as seed investments into new product lines have reached maturity and are delivering strong and stable rewards. To borrow a phrase from UNEP's *Green Economy* report from earlier this year, this marks the beginnings of "green growth": returns on investment "in economic sectors that build on and enhance the earth's natural capital or reduce ecological scarcities and environmental risks."

Green growth – to name just a few

A high-profile example of the value added in recognising low-carbon opportunities can be seen at General Electric (GE). Between 2005 and 2009, the company's investment in research and development behind its 'Ecomagination' growth initiative surpassed US\$5 billion. Coupled with the news that the company has committed an additional investment of US\$10 billion by 2015, this serves as a show of confidence in low-carbon, sustainability-related opportunities. Clear successes underpin this. According

Figure 1: Global GHG abatement cost curve beyond business-as-usual (v2.1) – 2030.



to comments made publically by GE’s CEO Jeff Immelt last June, Ecomagination is now one of the company’s most successful business initiatives, with revenues from its portfolio of energy efficient and environmentally beneficial products and services crossing the US\$18 billion mark in 2009 alone.

Central to GE’s success has been the strength of its commitment. Crucially, this goes beyond the sums invested and is reflected moreover in the fact that Ecomagination is a core, cross-company strategy. Without doubt this is the thread that ties together those companies making the best of the low-carbon opportunities at hand.

At BMW for example, its ‘EfficientDynamics’ initiative has improved fuel efficiency across all its vehicles since its introduction in 2002. As a result of early and comprehensive action, BMW ranks top among major manufacturers in terms of the speed at which it has improved the average carbon efficiency of vehicles sold, according to research from the European Federation for Transport and Environment. This stands the company in good stead for cost-effectively meeting stringent carbon emission regulations now present across its key automobile markets. Analysis from Liberum Capital, for example, estimates that BMW will spend less than half the annual amount to meet the European Specific Emissions Targets from 2012 when compared to competitors such as Daimler.

Doing more with less – a blue-chip focus on energy efficiency

It is perhaps no surprise that in sizing up the low-carbon economy, blue-chip companies have focused predominantly on lower-risk market opportunities related

to energy efficiency. Associated products and services typically offer customers relatively short pay-back periods where fuel savings outweigh capital investment costs, known as ‘negative abatement cost’ solutions.

Indeed a report from HSBC’s Climate Change Centre of Excellence recently noted that whereas the dominant feature of the low-carbon economy to-date has been a focus on altering the energy mix, energy efficiency will be the single largest investment opportunity by 2020 as government policies increasingly look towards improvements in the energy efficiency of buildings, industry and transport. This, they estimate, is a market set to grow at a compounded annual growth rate of 12 per cent to 2020, by which time it would reach a market size of US\$1.2 trillion.

As ‘win-win’ investments that reduce both energy costs and climate impacts, growth opportunities within this sector don’t rely solely on the appetite to tackle climate change. Rather, such solutions offer a number of ‘wins’ to related but separate concerns such as energy price volatility and energy security. ‘Smart-grid’ infrastructures that optimise the delivery of electricity provide a further example of this. IT giants such as IBM, Cisco and Oracle now market solutions to support a mass roll-out of Smart infrastructures, as are electric transmission and distribution specialists such as Schneider Electric and ABB.

Moving to the next phase of green growth

In view of this, the challenge for policy makers must therefore be to ensure the safe passage of projects that initially have a positive abatement cost – where investment costs are outweighed by cost savings.

McKinsey & Company highlight such projects on right-hand side of their often-cited 'abatement cost curve' as seen above. Not only are these projects necessary in order to meet suitably ambitious carbon reduction targets but many projects on this end of the scale are motivated solely on the grounds of mitigating climate change. Installing commercial-scale Carbon Capture and Storage (CCS) equipment is one such example. It is therefore essential businesses have the appropriate signals to continue investing in low-carbon solutions from governments around the globe as the 'win-win' opportunities subside.

With the seeds of a low-carbon economy coming to fruition, the emergence of global market leaders for low-carbon solutions is welcome news for investors.

Large sections of the investment community lend their support in this regard. The Investor Statement on a Global Agreement on Climate Change, which Jupiter signed in 2008, concludes that clear, credible, long-term policy signals are critical for investors to integrate climate change considerations into their decision-making process, and to support investment flows into a low-carbon economy. Progress towards an historic and ambitious global agreement on climate change would undoubtedly send the right signal. However, a continuation of the strong progress we have seen at national and regional levels of government is equally crucial.

Backing the best throughout

With the seeds of a low-carbon economy coming to fruition, the emergence of global market leaders for low-carbon solutions is welcome news for investors such as ourselves who seek to identify and invest in long-term outperformers. At Jupiter, we believe that a valuable signal of this rests in how fully companies understand and act appropriately on both the risks and opportunities associated with the transition to a low-carbon economy. This requires an 'engaged' approach to investment decision making whereby the right questions are asked of a company's strategic positioning around climate change and wider sustainability issues. This dialogue is naturally set within the practicalities of companies' operations and – in the same fashion as the approach taken within corporate leaders such as GE and BMW – is an increasingly integral part of investment research and decision-making.

To support us in our aim of generating strong returns for our investors, we are also taking a pro-active and vocal stance in advocating best-practice in corporate reporting around climate change. Jupiter is a founding signatory of

the Carbon Disclosure Project (CDP) – now a key source of information for investors on climate-related corporate risk and opportunity profiles. More recently, in July this year we joined organisations including Microsoft, Siemens and BT in signing an open letter from the Aldersgate Group to UK Government ministers arguing that "a clearer, stronger signal is needed now for the introduction of mandatory carbon reporting in the UK that is consistent with international standards".

Chief amongst the arguments for this measure is that mandatory carbon reporting would go a long way to providing investors with a fuller picture of companies' material climate risks and opportunities. Given the emergence of low-carbon growth within major corporations, as well as the successes of voluntary reporting schemes such as the CDP, we remain optimistic that large companies will play an integral role in tackling climate change.

[Additional research provided by Jonathan Wallace.]

Emma Howard Boyd is a Director of Jupiter Asset Management and Head of Sustainable Investment and Governance. She is also a Senior Associate of the University of Cambridge's Programme for Sustainability Leadership, a Director of Triodos Renewables Plc, and an Executive Board Member for the Accounting for Sustainability Project. She was founding Chair of Eurosif, the European Sustainable and Responsible Investment Forum, from its launch until the end of 2002, and was also Chair of UKSIF, the sustainable investment and finance association until March 2006.

Launched in 1985 as a specialist boutique, Jupiter has grown to be one of the UK's most successful and respected investment management groups. We currently manage assets spread across a range of UK and offshore mutual funds, multi-manager products, hedge funds, institutional mandates and investment companies. Jupiter has gained a reputation for achieving outperformance across a broad variety of portfolios specialising in different markets, including UK equities, Europe, global financials and emerging Europe.

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Bold new business models need to be created to meet the complex and interlinked challenges of resource scarcity.



Malini Mehra
Founder of the Centre for Social Markets (CSM)

Why business is buzzing on climate change

Setting tighter carbon emissions, leading the switch to low-carbon energies and anticipating future climate change legislation – some of the world’s biggest businesses are not only engaging with the issue of climate change but are increasingly leading the way in implementing low-carbon solutions across their operations. For Malini Mehra, business has moved from bystander to trendsetter on sustainability and climate change.

With the advent of ‘green giants’ such as Walmart, Unilever and Marks & Spencer taking the lead on sustainability, what would once have been regarded as wishful thinking is now taking place. Business, long criticised for standing on the sidelines of the debate has now entered the fray as a vocal advocate for action on climate change.

In the last two years we have seen the rise of global business summits on climate change – firstly in

Copenhagen and now in Mexico City. ‘Climate Week’ in September in New York brought together powerful business leaders, government officials and others in an exploration of the subject ‘Climate Innovation = Commercial Opportunity’.

Speaking at the launch of a major global report on corporate climate leadership, Dennis Nally, global chairman of PricewaterhouseCoopers (PwC) said, “As companies evaluate sustainability trends – such as competition for natural resources, economic globalisation and climate change – the likely outcome is a fundamental shift in business strategy ... We are finding that leaders in this area design corporate-level objectives to aggressively pursue growth while simultaneously reducing emissions.”

The 2010 *Global 500* Report* and leadership index issued by the Carbon Disclosure Project (CDP) and PwC found that carbon management is becoming a strategic business priority and competitive driver for the largest

global companies, in spite of the absence of a global agreement on climate change.

According to the report, carbon performance leaders are forging ahead of competitors – 85 per cent of these leading global companies surveyed reported having board or senior executive level responsibility for climate change and nearly half (48 per cent) are now embedding climate change initiatives into their overall business strategy and across their organisation.

Carbon disclosure: an uneven picture

However, the level of engagement with climate change isn't equal. The *Global 500* Report* was dominated by European firms and four out of the top five global leaders for carbon disclosure and performance were European – namely, Siemens, Deutsche Post, BASF and Bayer. The fifth was Korean electronics giant, Samsung.

Companies from the US and China – the world's two largest emitting nations – significantly lag behind European firms but even here the picture is changing. The Standard and Poors (S&P) 500 Carbon Performance Leadership Index (CPLI) ranked Cisco Systems, Consolidated Edison, News Corporation, Praxair and Spectra Energy among the leading firms on climate change in the US. According to the CPLI, the carbon-intensive sectors – including utilities, materials, energy and industrials – constituted more than half of all leading firms (nine out of the 14), indicating that “those companies that have been most regulated may already have many of the mechanisms in place to facilitate the transition to a low-carbon economy”.

In China, the government has introduced a range of low-carbon measures to encourage companies to implement a carbon measurement and management strategy. Once carbon emissions data collection systems are improved in Chinese firms, one can expect to see

greater representation by China in international rankings.

Commenting on this trend, Paul Dickinson, CEO of CDP says, “Companies globally are seizing commercial carbon opportunities, often acting ahead of any policy requirements. More companies than ever before are reporting through CDP and measuring and reporting their emissions which is the first building block in working towards a low-carbon economy.”

Making public interventions

Companies are also adding their voice to a growing chorus calling for political leadership and policy reform. In September, Marius Kloppers, chief executive of the world's largest mining company, BHP Billiton, issued an unprecedented call on the Australian government for a price on carbon, arguing that such a measure was needed to maintain the country's competitiveness in anticipation of an eventual global regime. Further, he added cheer to those calling for improved price signals by saying, “Carbon emissions need to have a cost impact in order to cause the consumer and companies to change behaviour and favour low-carbon alternatives”.

Such interventions in the policy debate are likely to grow rather than diminish as business leaders take stock of the present political context and seek to advance action for a competitive, low-carbon future.

Carbon management is becoming a strategic business priority and competitive driver for the largest global companies.

Such a pro-active approach was evident at the Business for Environment (B4E) Climate Change Summit held in September in Mexico City ahead of the UNFCCC conference in Cancun. Organised by Global Initiatives, UNEP, the UN Global Compact and WWF, the summit brought business leaders from influential South American and global corporations with strong representation from the energy, information and communication technologies (ICT), and buildings and construction sectors. It proved an impressive line-up: Walmart, the Coca-Cola Company, Grupo Bimbo, PepsiCo, Hewlett Packard, AP Moeller Maersk, Cemex, Tata and Sons, Acciona, Siemens, Nestle, McKinsey, Volvo Group, British Telecom Group, and a host of others.

In a declaration following the summit, the major energy companies present agreed that 100 per cent renewable energy by 2050 is achievable and something they would work towards as a sector. ICT companies agreed to reduce 7.6 Gigatonnes of CO₂ emissions by 2020. Building sector representatives committed to reducing emissions 40 per cent by 2020 in new buildings and boost energy efficiency by up to 40 per cent in existing buildings.

Green can indeed be the new gold.



© Stockphoto

Change starts in the workforce

Speaking of the need for business engagement, Georg Kell, executive director of the UN Global Compact, said, “While governments hold the key to setting the right signals and incentives, it is business that provides the solutions we need ... Now is the time to support the many efforts that already exist, to ensure that low-carbon innovation is shared widely and to mobilise those still sitting on the fence. We cannot afford to wait any longer.”

Nor was this just a brandfest of the biggest corporate brands; many present also pointed to their role in encouraging action from their suppliers and SMEs. José Luis Prado, president of Gamesa, said, “We recognise the role that big corporations have in changing supply chains so that small and medium enterprises can fully participate in the green economy”.

“Gone are the days when business was afraid to articulate a brave new global vision.”

Behavioural change and the power of engaging employees also emerged as key issues. The Volvo Group’s Magnus Kuschel, managing director of Commute Greener, emphasised, “We recognise the possibility we have in changing behaviours, starting from our companies. We can walk the talk and enlist the hundreds and thousands of employees that work for our companies as solution providers”.

Gone are the days when business was afraid to articulate a brave new global vision. Such events now routinely end with public declarations of commitment to climate action and a call for strong global public policy, a level playing field and supportive national legal frameworks.

A new force for green

The B4E Mexico business summit went a step further by advancing a set of national policy instruments that countries should put in place. According to the companies present, these were:

- financial mechanisms to offset initial costs and reallocate total costs along the life cycle of buildings;
- the phasing out of fossil fuel subsidies;
- soft loans for climate solutions;
- smart-grids, feed-in tariffs and buy-downs in energy that send the right signals to the marketplace.

If they are not already, policymakers need to sit up and take note. Business is increasingly differentiating along sustainability lines and new climate allies are emerging. For a growing number of global corporate players, action on climate change is not a maybe; it is a must to ensure their own long-term competitiveness.

Some companies may still face issues of trust and charges of ‘greenwash’ and these will have to be overcome. What is clear is that yesterday’s carbon intensive business models will not succeed in a leaner, greener tomorrow.

The game changers will be those who embed sustainability throughout their value-chain and create bold new business models to meet the complex and interlinked challenges of resource scarcity, the needs of nine billion people and an increasingly fragile natural world. In doing so, they will redefine the marketplace of the future.

“Yesterday’s carbon intensive business models will not succeed in a leaner, greener tomorrow.”

None of this can come too soon, of course. But there is a surprising amount of inspiration to be found in business today. Green can indeed be the new gold.

Malini Mehra is the Founder & CEO of the Centre for Social Markets. She has worked on sustainability issues in civil society, business, and government for more than 20 years. Her experience ranges from major international NGOs such as Oxfam and Friends of the Earth, to working in the UN and in government. While at the UK government, she initiated the pioneering Sustainable Development Dialogues with China, India, Brazil, South Africa and Mexico. She also served as adviser to former UN Secretary General, Kofi Annan, on UN-civil society relations. At present, she serves on a number of advisory boards including major companies such as Unilever, BHP Billiton and Kimberly-Clark.

The CSM is an independent, non-profit dedicated to making markets work for the triple bottom line- people, planet and profit. Through offices in India and the UK, and an international network of partners and associates, CSM works to accelerate the transition to sustainable development. CSM’s primary constituencies are domestic industry and stakeholders in developing countries, and Diaspora communities in industrialised countries. Founded in 2000, CSM has been at the forefront of climate mobilisation and advocacy in India promoting a pro-active leadership agenda by the country. CSM’s 2009 film, ‘In Good Company’, profiles emerging corporate leadership on climate change in India featuring both household names and newcomers. CSM also hosts the India Climate Portal and publishes the annual ‘Who’s Who in Climate Change in India’.

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Keeping below the two-degree climate threshold will be impossible without a significant reduction in tropical deforestation.



Jens Stoltenberg
Prime Minister of Norway

Stepping up climate and forest action:

Countries are already acting to save the world's remaining tropical forests

Prime Minister of Norway, Jens Stoltenberg, examines the global efforts to halt the deforestation of tropical forests through the REDD+ initiative. He explains why Norway committed to providing up to US\$500 million a year to this cause at the Bali climate change summit in 2007 and elaborates on the developments that have taken place since. He emphasises the importance of securing an agreement on REDD+ at the UN climate change meeting in Cancun so international efforts can be rapidly scaled up by means of a global mechanism.

The case for climate and forest action

Since the 13th round of climate change talks were held in Bali in 2007, the proposal Reducing greenhouse gas Emissions from Deforestation and forest Degradation in developing countries (termed REDD+ in the UN negotiations) has become a hot topic. Subsequent international climate change negotiations led to the establishment of an interim REDD+ Partnership of almost 60 countries at the Oslo Climate and Forest Conference in May this year.

REDD+ is the most important and cost-effective short- and medium-term climate change mitigation opportunity at our disposal. While there is uncertainty about the precise numbers, it is clear that keeping below the two-degree climate threshold will be impossible without a significant reduction in tropical deforestation. By some estimates, as much as one third of the cost-effective mitigation needed in 2020 could come from REDD+.

Immediate, large-scale and coordinated action on REDD+ will give us the time we need to develop the clean technologies and jobs of the future. However, REDD+ must be a complement to, rather than a substitute for, deep cuts in rich countries' emissions.

The global benefits of REDD+ are enormous in terms of mitigating climate change and conserving biodiversity on a large scale. However, local benefits are equally impressive. REDD+ can contribute to sustainable economic development and poverty reduction. Standing forests preserve rainfall patterns and help communities and countries to adapt to the climate change that will inevitably occur regardless of our success in reducing global emissions. They also play a vital role in the culture of millions of indigenous people.

In sum, these are the reasons why the Government of Norway made the pledge in Bali to provide up to half a billion US dollars a year for REDD+.

The challenges of forest climate action

As many have pointed out, there are important risks involved with REDD+, including risks for indigenous peoples and local communities. However, the status quo is not risk-free, and business-as-usual is not an alternative. Rather, we must address the risks head on. In order to deliver lasting results on deforestation, developing countries will have to improve their forest governance, and radically increased levels of transparency will be required. Financial mechanisms



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Brazil's Minister of Environment Carlos Minc, Norway's Prime Minister Jens Stoltenberg and Norway's Minister of the Environment and International Development Erik Solheim exploring the Amazon rainforest in 2008.

must be established that balance control over development spending priorities with the application of high international safeguards standards. This will be challenging, but it can be done.

The climate change negotiations

The economic drivers of deforestation are strong. Global demand for timber, palm oil, sugar, soy and beef, and the need to feed three billion more people by 2050 will all continue to put pressure on forests. A successful reduction of global deforestation rates will depend on our ability to offer an alternative income stream that reaches the actors that make decisions on land-use.

Significant, lasting, global REDD+ results can best be achieved through the adoption of a UN agreement that puts a value on forest carbon. Considerable progress has been made in the negotiations, and the parties came very close to reaching agreement on a REDD+ mechanism at the climate change summit in Copenhagen in December last year.

Key issues remain to be resolved. An operational REDD+ mechanism will require an overall agreement on financing and institutions. We must continue to work towards a global agreement. At the same time, we can and must act immediately. Early action will deliver significant short-term emission reductions. Even more importantly, it will allow us to see what works and what doesn't, so that we are ready to scale up immediately once the UN global mechanism is up and running. Luckily, such action is already being taken on an unprecedented scale.

A multilateral climate and forest architecture

In May this year, I was proud to host the Oslo Climate and Forest Conference together with President Yudhoyono of Indonesia. The conference culminated in the establishment an interim REDD+ Partnership

of approximately 60 countries. The purpose of this partnership is to rapidly scale up action and financing on REDD+ and improve coordination, transparency and knowledge transfer between ongoing and future REDD+ initiatives. Putting the REDD+ Partnership into practice will be challenging but I am confident it will become a unique feature of the international climate change landscape and an example for other sectors to follow.

The Partnership was the result of an intense effort since Bali to put in place an integrated and effective multilateral, institutional architecture to support global REDD+ efforts. More than 40 countries are preparing to implement national REDD+ strategies under the UN REDD Programme and the Forest Carbon Partnership Facility. Some countries are already scaling up their efforts under these two programmes and under the Forest Investment Program. The Forest Carbon Partnership Facility's Carbon Fund will become the first multilateral mechanism that pays developing countries to reduce forest emissions. Collaboration between these UN- and World Bank-administered initiatives is exceptionally good, and we are well on our way to seeing a truly integrated architecture to support REDD+ efforts.

The Congo Basin Forest Fund, administered by the African Development Bank, is meanwhile focusing on the particular needs of the Congo Basin countries.

A broad constituency of forest countries has emerged and is now eager to get REDD+ started on the ground. The multilateral and bilateral initiatives as well as a plethora of academic institutions and civil society organisations are together creating a global community to support REDD+ action. Success stories are emerging, and we are learning and sharing valuable lessons every day. These developments are remarkable and in many cases, developing countries are leading the way.

Developing countries taking the lead

Leadership in reducing tropical deforestation belongs at the highest levels of government. Only through a holistic national strategy, anchored and implemented at all levels of government and society, can the powerful forces of deforestation be addressed and kept in check over time. Heads of State and government can therefore play a particularly crucial role.

The benefits of such top-level leadership are particularly evident for three of the countries that have come furthest in their efforts, and whose efforts Norway is proud to be supporting.

In Brazil, deforestation in the Amazon has decreased by more than 60 per cent from the 1996–2005 average, since President Lula initiated his government's anti-deforestation efforts. The historical correlation between prices of raw materials and deforestation appears to some extent to have been broken. Preliminary reports indicate still further reductions have been made in the last year. In 2008 the Amazon Fund was established as the first prototype of a large-scale, sectoral payment-for-reduced-emissions scheme with a view to deepening and sustaining results in the long term. Moreover, President Lula and his government have unilaterally committed Brazil to reducing emissions to nearly 40 per cent below

the business-as-usual scenario, making Brazil a leader on climate change in general and of REDD+ in particular.

Several years ago, President Bharrat Jagdeo of Guyana proposed a concept for combining “pay-for-performance REDD+” with a comprehensive strategy for putting Guyana on the path to sustainable, low-carbon growth. With Norwegian support, the Guyana REDD+ Investment Fund’s first low-carbon investment projects will be launched later this year. President Jagdeo’s tireless advocacy has been invaluable in creating consensus on the role of REDD+ in addressing climate change. More than anyone, he has helped to foster a broader understanding of the market failure inherent in deforestation and of the need to address deforestation through global incentive structures that put a price on forest-related greenhouse gas (GHG) emissions.

President Yudhoyono of Indonesia has made his country a leader on climate change through bold unilateral commitments. He has also invited developed countries to join a partnership to protect Indonesia’s remaining forests and peatlands, and my government is proud to be a founding member. This results-based partnership will move to scale immediately, through substantial institutional reform and the establishment of a comprehensive moratorium on new concessions for the exploitation of peatland and forests. By 2014 it should have evolved into a pure contributions-for-verified emissions-reductions model.

Other leaders are emerging: Ministers from the Congo Basin countries have joined forces in the Congo Basin Forest Partnership. The Democratic Republic of Congo has made substantial progress in preparing for REDD+ and is now a best-practice example of how multilateral initiatives can work jointly in support of a government’s strategy.

Key elements for success

Based on the experience of Brazil, Guyana, Indonesia and other countries, the following key principles appear to be crucial to making REDD+ strategies effective and sustainable.

Strong and broad-based national ownership is needed, and REDD+ needs to be integrated into the country’s overall strategy for poverty alleviation and low-carbon development. To sustain public support, sectoral REDD+ strategies must be seen as integral priority elements of the national development strategy. The REDD+ strategies must also focus on optimising the additional benefits with regard to biodiversity, livelihoods and climate change adaptation. Relevant stakeholders, including indigenous peoples and local communities, must be actively involved in the formulation and implementation of the national strategy.

Payments for verified emission reductions, based on robust and independent monitoring, reporting and verification (MRV), must be at the heart of the approach taken. This will target policies and investments in such a way that they deliver results, and only results-based approaches are likely to generate the financing needed. All three countries outlined here consider payments for verified emissions reductions – supported by contributing

countries willing to commit to long-term partnerships – as crucial to ensuring sufficient, predictable, and sustainable funding, and as a means of assuring contributing countries that they are getting value for money.

Transparency and adherence to internationally recognised safeguards are essential for international partnerships to work. National control over development decisions must be carefully balanced against adherence to international financial, social and environmental safeguards and related transparency criteria.

Reducing tropical deforestation is intrinsically a development issue. But REDD+ is different from traditional development aid, being a payment for a global service. Clearly, rich countries’ taxpayers need to be assured that their money is being spent wisely, and is helping to put forest countries on sustainable, low-carbon development paths. Existing Official Development Assistance (ODA) financial intermediation mechanisms need to be reviewed to suit results-based climate financing. To be credible and effective, REDD+ requires – and reinforces – sound political and financial institutions.

Climate and forest action continues

Tremendous progress has been made since Bali in preparing the world for a global mechanism to reduce tropical deforestation. Unprecedented pledges for action and financing have been made. An integrated multilateral architecture is being created to support all committed forest countries in their readiness efforts. National strategies are being prepared, monitoring systems set up, and institutional capacities developed. Key countries are pushing rapidly ahead.

What is now required is predictable and sustainable medium- and long-term funding. This is needed in order to reward large-scale, verified reductions in tropical deforestation. I am hopeful that within the next year we will see more results-based REDD+ partnerships emerge. I remain hopeful that Cancun will deliver a decision on REDD+ so we can rapidly scale up our efforts to substantially reduce global deforestation.

Jens Stoltenberg has been the Prime Minister of Norway since 2005. He is co-chair of the UN Secretary-General’s High-level Advisory Group on Climate Change Financing. His government’s Climate and Forest Initiative aims to include tropical deforestation in a global climate regime, focusing on results-based financing and drawing on experience gained in Brazil, Indonesia and Guyana.

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Viken Skog BA is a cooperative forest association in south-eastern Norway, owned by some 12,000 forest owners. They represent more than 80 per cent of all forest owners in the catchment area. Viken Skog buys approximately two million m³ timber per year from its members, and sells the timber to sawmills and the pulp and paper industry. Viken Skog can also organise logging operations on behalf of its members and provides services relating to planting, forest management and environmental protection on members' properties.

The big challenge of small forest incomes

In total, the cooperative members of Viken Skog control almost one million hectares of productive forest, which means the average forest property is 80 hectares. Every year, approximately 5,000 of the 12,000 members supply timber to Viken Skog. The majority of forest owners have small properties, and the challenge is to ensure that these owners manage their forests well, despite deriving a modest income from them. Surveys show that for around 80 per cent of forest owners in Viken Skog, annual earnings from the forest represent less than 15 per cent of total household income.

Norway's forests as carbon sinks

Norway has relatively little forest compared to neighbouring countries such as Finland. Yet over the last 100 years, all forests in Norway, including the area of Viken Skog, have grown significantly. Today, Norway's annual increment of growing stock (25 million m³) is more than double the total area that is logged, which is just 10-11 million m³. This means that the forests absorb as much as 25-30 million tonnes of CO₂ per year. In addition, the use of wood as fuel and building materials reduces net emissions of CO₂ by approximately 10 million tonnes per year. With a lot of growing forest in its most productive stages, the forest will also absorb and store vast quantities of CO₂ in the years to come.

A forest cooperative – a model of sustainable forestry in Norway

It is important for future generations that the forest is regenerated and well-managed to achieve optimal forest production. In Norway, it takes a newly-planted tree 50-120 years to reach felling maturity.

Forestry is an economic activity with a long-term outlook, and climate actions in the forest must be viewed in the context of the next 80-100 years.

Planting after harvesting: a duty and a tradition

In Norway, the Forestry Act instructs all forest owners to regenerate the forest after logging. The forest owner must arrange for either planting or natural regeneration before the logging can begin. In addition to this, the forest owner must set aside a certain amount of money from the sale of timber to cover actions for regeneration and other long-term investments in the forest. These rules have resulted in the accumulation of a vast forest resource in Norway. The tradition within forest owning families to hand over the forest property to the next generation in at least the same shape as it was when one took charge of it, has been a success for the forest sector. It is a challenge for Viken Skog and other organisations to motivate forest owners to continue to be ambitious in regenerating the forest.

Wood – a climate-friendly building material

An important part of the climate balance is the use of wood in construction. By substituting less climate-friendly building materials with wood, the climate balance will be positively affected. Wood produced by photosynthesis in the forest will be absorbing CO₂ as long as it does not burn or rot. Buildings made of wood can store CO₂ for hundreds of years. Within the Viken Skog area, there are stave churches which are as much as 900 years old.

The challenge in the future will be to facilitate a modern use of wood in buildings which are both durable in the long term, and also fulfil the society's demands for design, user friendliness and aesthetics. This may be achieved by using wood products such as laminated timber and cross laminated solid timber in taller buildings in cities and local communities. To showcase the use of wood as a modern building material, Viken Skog chose to build its own four-storey head office in 2007 entirely from cross laminated solid timber and glass, just outside the city of Hønefoss. Oslo Airport Gardermoen has also made extensive use of wood both as surfaces and in structural parts of the terminal.

The potential of biomass

Norway has a lot of hydroelectric power used to produce clean electric energy. Today, approximately 70 per cent of all heating in Norway comes from hydroelectric power, and it is a national goal to convert this to other renewable sources of energy, including energy from biofuels. Viken Skog is active within the whole value chain to develop and produce biofuel for the production of heat in the shape of steam from remote heating plants and local heating plants.

Biomass refined into oil products is another CO₂-neutral carrier of energy which may be used for fuel in the transport sector among other uses. Viken Skog is actively participating in research and technology to promote the use of biomass for tomorrow's bioenergy market. For the forest owners it is important to make the most of their forest properties and intensify the use of biomass for new purposes. There is a great potential in facilitating the use of treetops, branches, shrubbery and other suitable crops for the production of heat. Even if the use of wood for bioenergy were to be multiplied several times compared to the level in 2010, it would not reduce the ability of the standing forest to absorb CO₂ through its natural growth.

Certified forestry: the PEFC and FSC standards

All timber sold by forest owners to Viken Skog carries an environmental Programme for the Endorsement of Forest Certification (PEFC) certificate issued by the certification agency Det Norske Veritas. Part of the timber is in addition Forest Stewardship Council (FSC)-certified using the Woodmark standard. With these two internationally recognised certifications, customers can be assured that the forests are sustainably managed and that practices to preserve forest biodiversity are upheld.

What makes forest management sustainable?

The individual forest owner is responsible for managing his or her forest according to the relevant certification principles (PEFC or FSC). Viken Skog offers to perform an environmental review for all its forest owners. By 2012, all forest owners within Viken Skog will have completed a comprehensive review of their land and registered any particular environmental values such as key habitats for protection. Forest owners who choose

not to participate in the environmental area review must, in order to log and sell timber from their land, carry out their own environmental review with an appropriately skilled assessor to ensure that the forestry activities are performed sustainably. Through annual internal and external audits, Viken Skog ensures that the environmental standards, such as the conservation of key habitats to protect biodiversity, are upheld.

All the forest owners are offered training through courses and reading material in order to improve their knowledge about the environmental aspects of forestry, and are also offered refresher courses from time to time.

Machine logging – training crucial for machine operators

Almost all timber is logged by forest harvesters, and as much as 75 per cent is administered by Viken Skog's district foresters. Since so much of the logging is done by forest harvesters and there are many logging jobs during the year, the operator of the forest harvester plays a vital role. It is the operator's evaluations and performance which often decide whether the logging is done according to agreed quality and environmental standards. It is therefore critical that the operator not only has good knowledge of logging procedures but also has a clear understanding of why procedures must be followed to the letter. Competence in the quality and environmental requirements for sustainable forest management is a prerequisite for a skilled forest harvester operator.

Online information for members

Ensuring accurate and updated information reaches the cooperative's thousands of forest owners is a great challenge, especially in cases where the income from forestry activities is of little economic importance. Many forest owners have little annual activity in their forest and only rarely sell any timber (perhaps as little as every 10 years). An increasing number of forest owners now look to the internet for information regarding forestry. For these reasons, information concerning timber sales and environmental certification is now easily accessible via the Viken Skog website.

The annual environmental report documents key developments in areas such as logging procedures and sustainability. This information is accessible via the separate members' area within the Viken Skog website.

The cooperative also issues a members' magazine where all members can read feedback from the annual external quality and environmental audit and other forestry news.

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Tropical forests sustain half of all life on earth, about 6 million species of living creatures.



His Excellency, President Bharrat Jagdeo of Guyana

Creating incentives for avoiding deforestation and forest degradation

Action to save the world's forests is vital – and possible now. Guyana's partnership with Norway is already working to provide a model for REDD+ incentives to avoid deforestation and forest degradation. Payments from Norway for the climate services provided by Guyana's forest are making the forest worth more alive than dead. And Guyana is investing these payments in renewable energy, better forest governance and community-led sustainable development projects. This is all part of our work to re-orient our economy onto a low carbon trajectory, and we hope that in a small way, we are providing insights for others across the world.

It will be mathematically impossible to reach climate stabilisation unless the international community moves quickly on four fronts. We need to simultaneously improve energy efficiency, transition to clean energy sources, improve agricultural productivity and slow down net deforestation.

Much of the world seems to be waking up to the need to create solutions for energy efficiency and clean energy. But the importance of land use – in other words, agriculture and forestry – still remains unclear to many. Changing this reality is vital and do-able: action to stop deforestation and forest degradation can start now.

Achieving no net annual deforestation by 2030 IS possible

Deforestation and forest degradation currently produces about 17 per cent of all greenhouse gas (GHG)

emissions. Yet it is possible and affordable to achieve no net annual deforestation by 2030. That would be the equivalent of eliminating all the GHG emissions generated by the entire European Union.

Moreover, saving the world's tropical forests would not just make an immense contribution to climate stabilisation but also protect the planet's incredible biodiversity. Tropical forests sustain half of all life on earth, about 6 million species of living creatures. They provide the world with the majority of its medicines, saving the lives of hundreds of millions of people. Forests generate rainfall without which the agricultural industries of North America, Europe and elsewhere could not survive. And to many people, forests are also a spiritual home and source of wellbeing impossible to value in monetary terms.

Creating new incentives is the key

So how can we save the world's forests? The first thing is to face up to the reality that we are currently part of a global economy that values the timber that forests

“This world economy does not value the vital climate and biodiversity services that forests provide. Put simply, forests are worth more dead than alive.”

supply and more critically, the agricultural produce that can be grown on the land after trees have been cleared. This world economy does not value the vital climate and biodiversity services that forests provide. Put simply, forests are worth more dead than alive.

It is easy to caricature deforestation as capricious governments colluding with corrupt logging companies, and this is sometimes the reality. But most deforestation is caused by individuals, companies and communities pursuing legitimate social and economic goals. It is not just illegal loggers; it is also the African mother who needs charcoal to cook for her children, the Asian farmer who produces palm oil to earn money and the South American soya entrepreneur who provides employment for thousands. These people cannot be expected to voluntarily give up their livelihoods to help solve a climate change problem they didn't cause.

“If forest peoples and countries are treated as passive recipients of aid, we will fail.”

And this is the main reason that every day, at least 32,000 hectares of rainforest disappear in countries across the world – despite decades of work to secure forestry protection through philanthropy and well-meaning conservation attempts.

So the only way we can halt deforestation in the long term is by creating new economic incentives to value the services that forests provide, and to enable new economic and employment alternatives in forest countries to tip the balance against the economic forces which drive deforestation.

REDD+ can make forests worth more alive than dead

The UN Framework Convention on Climate Change (UNFCCC) and REDD+ provide us with an historic opportunity to save the world's forests by putting a value on the climate services they provide. However, while this opportunity is welcome, it will only become a reality if both forest countries and the rest of the international community work together to make it one.

To do this successfully, we need to recognise that the solutions for REDD+ must primarily come from within forest communities and countries. If forest peoples and countries are treated as passive recipients of aid, we will fail. Most of the knowledge, intellectual energy and innovation needed to identify and implement successful solutions can only come from those people who understand the societies and economies of forest countries best.

The good news is that forest communities and countries across the world are willing to play their part. What is missing is the change in global economic incentives that make forests worth more alive than dead. Guyana is of the view that these must be created within a legally binding, international climate treaty as soon as possible and we will continue to support specific

proposals that target global carbon neutrality in the forestry sector by 2030.

But we can get started now, even in the absence of a full global agreement. Guyana supports the recommendations of the Informal Working Group on Interim Financing for REDD+ (IWG-IFR), which outline how action on deforestation and forest degradation can start immediately. The IWG-IFR report sets out ways to achieve a 25 per cent reduction in global deforestation rates by 2015 for a cumulative total of less than €25 billion. Not only is this one of the cheapest abatement solutions available but, if successful, it could deliver 7 gigatonnes (Gt) in cumulative emissions abatement. This would be by far the biggest contribution to the fight against climate change in that period.

Guyana: seeking a way forward on REDD+

In Guyana, we have long recognised that we should seek to help build the international partnerships we need, and through our work with Norway, we have found an international partner who shares our views on the need for economic incentives to save the world's forests.

Our partnership has its roots in October 2007, when I expressed my long-held belief that the people of Guyana did not just want to complain about climate change, even though we are already suffering from its impacts. In 2005, we experienced floods which caused damages equivalent to 60 per cent of our GDP.

I said that we were ready to be solution-finders and proposed two ideas. The first was that I believed that the people of Guyana would be willing to help in the global battle against climate change by putting the majority of Guyana's forest, which is the size of England, under long-term protection provided the right economic incentives were created and the people's sovereignty over the forest was not sacrificed. Secondly, I expressed my belief that the people would be willing to invest the income Guyana received from these incentives to forge a new, low-carbon economy.

This led to our Low Carbon Development Strategy (LCDS), which resulted from a comprehensive, national consultation involving over 10 per cent of our population. The LCDS sets out specific measures to ensure that Guyana's national development and the fight against climate change are complementary, not competing, objectives.

At its core is a forest payments incentive system, which we hope provides a scalable, replicable model for addressing deforestation and forest degradation. The government of Norway has made voluntary commitments to pay for up to US\$250 million for forest carbon abatement in Guyana at US\$5 per tonne during the period 2010-2015. Guyana invests this revenue in the priorities identified in the LCDS. We have created the Guyana REDD+ Investment Fund (GRIF) as the financing mechanism, and asked the World Bank to act as trustee of the fund.

We estimate that a further US\$100 million total for the period 2011-2015 will supply sufficient revenue for Guyana to create the world's first national scale forest

climate services scheme and catalyse transformative private investment of up to US\$2 billion in identified low-carbon priorities.

Incentives are working

Now that we have incentives for avoiding deforestation and forest degradation in place, we are able to start the transformation of the Guyanese economy through a balanced blend of large-scale strategic investment and community-led economic and social empowerment activities.

For example, we are using forest payments to catalyse significant private finance to build hydro-power capacity. This will deliver cheaper electricity to our citizens and businesses, and simultaneously enable Guyana's power sector to transition to nearly 100 per cent clean, renewable energy sources.

We are starting to nurture private sector investments in six transformative low-carbon sectors and over a billion dollars in annual export potential from low-carbon

“Incentives to protect forests are not a side issue in the fight against climate change: there is no solution to climate change without them.”

sectors is being pursued. In parallel, we are starting to implement almost 200 Community Development Plans created by our Amerindian (indigenous) communities. Based on priorities identified by villages, initial work includes installation of solar power in villages; expansion of IT networks to connect communities with government services and markets for their produce; and provision of specific assistance for new economic sectors.

We are also expanding the national digital infrastructure including a fibre-optic link with Brazil; investing in small business low-carbon development; creating an International Centre for Biodiversity; strengthening forest governance; building better capabilities to monitor, report and verify forest carbon abatement; and expanding social and economic development programmes for indigenous peoples, forest-dependent communities and vulnerable groups.

An international blueprint for forest protection?

I would not want to suggest that Guyana's is the only relevant model for forest protection. Every forest country must be free to determine for themselves how best to access and use internationally available incentives for forest payments.

However, incentives to protect forests are not a side issue in the fight against climate change: there is no solution to climate change without them. And national

models can inspire the broader international community to believe that success is possible. So we hope that we can provide part of that inspiration. We believe that we are starting to prove that incentives for forest protection work. We also believe that we are working through the practical, detailed steps for earning and investing the incentives in ways that safeguard the rights and legitimate aspirations of our citizens.

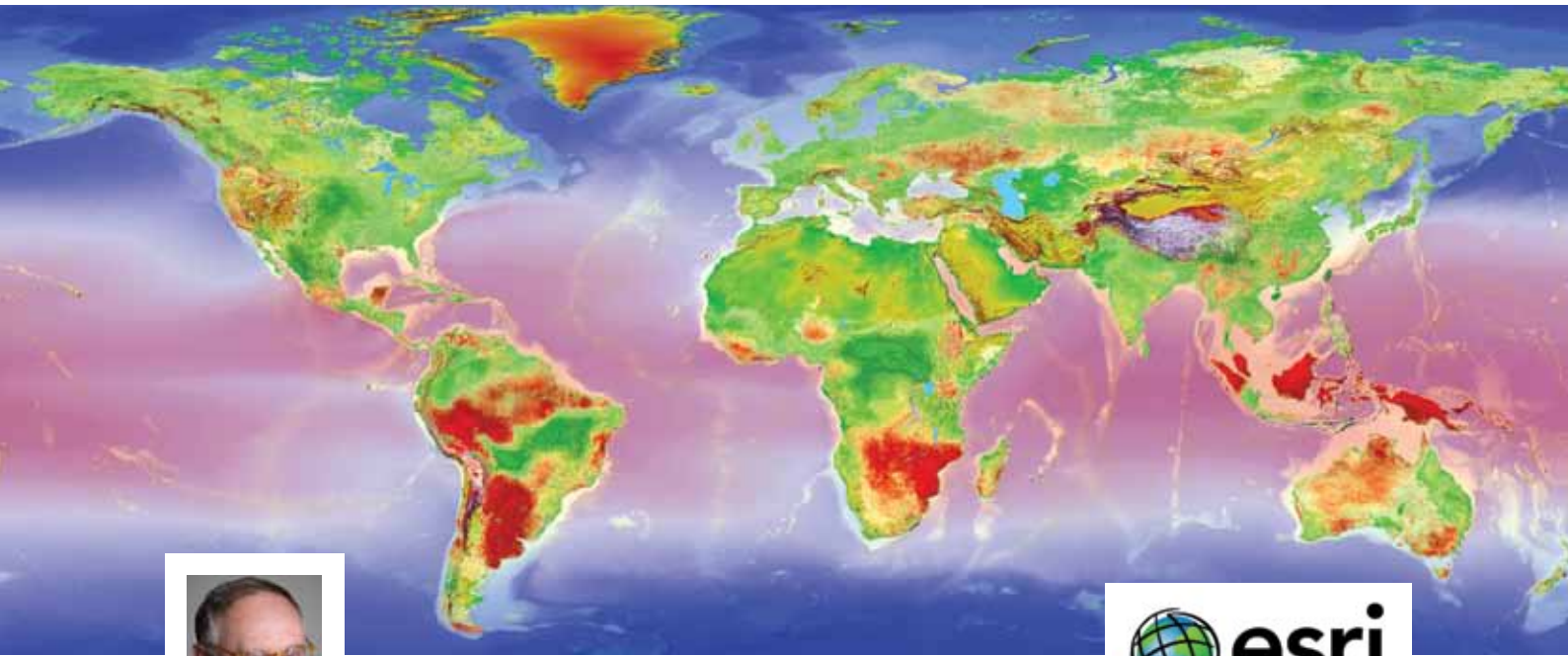
Based on our experience, I believe that the international community can deliver three significant actions in the coming months:

- 1. International financing** of the scale set out in the IWG-IFR report should be put in place to create the incentives needed to achieve a 25 per cent reduction in deforestation and forest degradation by 2015. This would cost less than €25 billion total over five years. As a 'price' for 7Gt of emissions reductions, it is evidently value-for-money.
- 2. Forest countries should put forward their own strategies** on how they can deliver their side of the bargain. Large numbers of forest countries have said that they are ready to act if the incentives are put in place – and several countries, including Guyana, show that ambition on REDD+ also delivers major progress in biodiversity protection, poverty alleviation and overall national development.
- 3. A specific financial mechanism for REDD+ should be agreed** by the international community and be implemented immediately. Some people think this is a point of detail but it is absolutely crucial – without the GRIF, the Guyana-Norway partnership would not be able to move forward.

All of the three actions I propose are do-able now. Cumulatively over the next five years, they could deliver the single biggest reduction in GHG emissions in history. They can also build the foundation for a long-lasting REDD+ solution. Most importantly, they can align the development interests of forest countries with the action we need in the battle against catastrophic climate change. This is the fight of our generation, and the right action on forests can help us to win it.

Bharrat Jagdeo has been President of Guyana since 1999. Long an advocate for meaningful reform of international institutions, he was the Chairman of the Board of Governors of the IMF and World Bank in 2005. He is outspoken about the need for urgent action on climate change and the important role of developing countries in determining that action. President Jagdeo was awarded the United Nations "Champion of the Earth" award in 2010. Time Magazine and CNN also named the President as one of their "Heroes of the Environment 2008". In early 2010, the Secretary General of the United Nations asked President Jagdeo to serve on the Secretary General's High Level Advisory Group on Climate Finance.

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Jack Dangermond
Esri



A systems approach to climate change

GIS gives us hope

Geography is a fundamental science that helps us describe the natural and human systems of our planet, including components that contribute to and are influenced by climate change. Geographic information system (GIS) technology gives you a comprehensive understanding of complex systems so that you can make informed, actionable decisions.

People use GIS every day to view and manage information about geographic features, analyse geographic relationships, and model geographic processes. As a foundational technology, it lets local, regional, and global organisations collect, manage, and analyse a myriad of physical, biological, and cultural data describing earth.

GIS is a simulation of the earth with powerful tools that can assess future climatic conditions based on different management approaches. The result is power and flexibility, making it the system of choice for analysing and managing earth's complex systems.

A proven system for climate change

GIS facilitates the geographic approach to decision making – a new way of thinking and problem solving that integrates geographic information into how we understand and manage global issues resulting from climate change. It's a systematic approach that allows

us to 'create' geographic knowledge by measuring the earth, organise this data and analyse and model various processes and their relationships. It also allows us to 'apply' this knowledge to the way we design, plan, and change our world.

GIS is an established technology with a long history of driving climate science and environmental decision making. Decision makers, policymakers, planners, scientists, and many others worldwide, rely on GIS for addressing complex problems such as:

- Climate science and modelling;
- Sustainable planning;
- Renewable energy planning;
- Rainforest management;
- Carbon accounting and assessment;
- Biomass and land-use inventory;
- Reporting and compliance;
- Disaster planning and management;
- Real-time communication;
- Community awareness and engagement.

GIS users represent a vast reservoir of knowledge, expertise, and best practices in applying this cornerstone technology to the science of climate change and understanding its impact on natural and human systems.

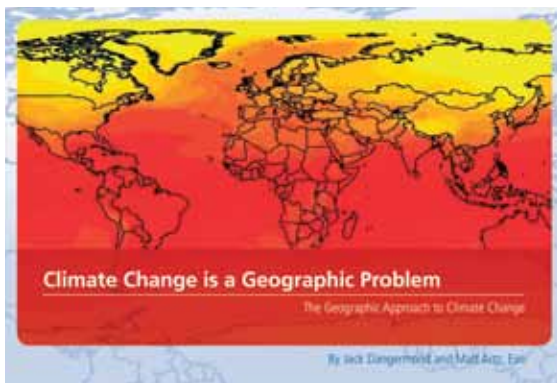
Climate change is a geographic problem, and we believe solving it takes a geographic system

A GIS-based framework for climate science gives us hope. With it we can gain a scientific understanding of earth's complex systems at a truly global scale and make thoughtful, informed design decisions that ultimately allow humans and nature to coexist more harmoniously.

Read about the many ways GIS is already being used for climate change research on our website and see how Esri works with organisations worldwide to create GIS applications that meet the climate change challenge.

Visit www.esri.com/climatechange to receive your free e-book. Available e-book titles below:

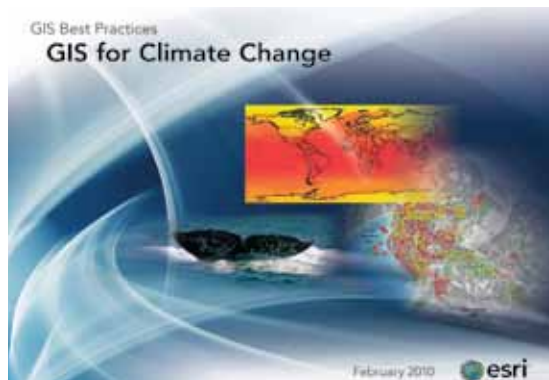
Climate change is a geographic problem



The geographic approach to climate change

A GIS-based framework for climate science helps us make thoughtful, informed design decisions that allow humans and nature to coexist more harmoniously.

GIS for climate change



Case studies in the use of GIS for climate change

Eleven case studies illustrate how GIS is helping us to gain a better understanding of the impact of climate change on natural and human systems.

"GIS provides Guyana with the tools it needs to scientifically measure and analyse our natural resources effectively. With GIS, we can support responsible resource management decisions that benefit generations to follow."

Bharrat Jagdeo
President of Guyana

"GIS can help us become visionary rather than reactionary."

Chad Kopplin
Wyoming Department of Environmental Quality

"Monetary flow through the Reduced Emissions from Deforestation and Forest Degradation (REDD) mechanism to forest communities is slowed by the problems of unclear land ownership. A key factor in the success of REDD is the application of GIS to collate, map, and report forest carbon emission information to investors and international regulatory agencies."

Dr. James Baker
The William J. Clinton Foundation, in 'The Economist'

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In 1969, Jack Dangermond founded Esri with a vision that computer-based mapping and analysis could make significant contributions in the areas of geographic planning and environmental science. The recipient of 10 honorary doctorate degrees, he has served on advisory committees for the National Aeronautics and Space Administration, the Environmental Protection Agency, the National Academy of Sciences, and the National Science Foundation.

Website: www.esri.com/climate

Slash and burn agriculture in the Amazon.



Izabella Teixeira
Minister of Environment for Brazil

Brazilian policy to address climate change: relevant role to REDD+

Forests are globally important carbon sinks and play a critical role in mitigating climate change. The international mechanism for protecting the world's forests, Reducing Emissions from Deforestation and forest Degradation (REDD+), is one of the main contributions that forest-rich nations such as Brazil can make to reduce global warming.

REDD+ has been seen as an easy and effective way to combat climate change. However, the challenge of reducing the rate of deforestation for many developing countries is as big as the challenge to change the energy matrix for developed countries. In order to achieve the emissions reductions which REDD+ demands, many different actions have to be taken. It is not a 'non action' as cynics have suggested. Deforestation and forest degradation are results of common practices which involve many economic sectors and a sizeable part of the local population. REDD+ actions depend on many factors, are difficult to implement, all associated costs are difficult to account for, but they have the potential to bring many benefits, not only to the planet but to forest-dwelling communities too.

The wide-ranging role of forests make them fundamental to our very survival – something that is well known but not yet reflected fully in current actions to protect and conserve forest cover. Biodiversity, hydrological regulation, the livelihoods of forest communities, supply of timber and non-timber products and the conservation of carbon stocks are just some of the multiple benefits or environmental services that

are provided but not accounted for. In this regard, the REDD+ mechanism, in negotiation under the UN Framework Convention on Climate Change (UNFCCC), offers the tropical forests an opportunity to have at least part of this value acknowledged.

The broad scope of REDD+, encompassing not only reduction of emissions from deforestation and degradation, but also conservation and increase of forest carbon stocks and sustainable forest management, brings many challenges to the table. It requires that developing countries address not only the direct causes of deforestation and forest degradation, but also drivers such as land tenure issues and poor forest and agriculture governance.

The need to ensure the environmental integrity of the mechanism means that issues such as leakage, permanence and additionality have to be addressed. In this regard, Brazil believes that it is crucial to work to national reference levels and invest in a robust, transparent and up-to-date monitoring system. The national reference level approach has many advantages because it simplifies accountability, prevents national leakage and avoids perverse incentives.

A successful REDD+ strategy has to take into account all stakeholders' interests. It is essential that we build mechanisms and institutions capable of dealing fully with the preferences and interests of all stakeholders, in order to guarantee the long-term sustainability of all achievements realised by the implementation of the REDD+ strategy.

A successful REDD+ strategy is also related to the adequate assessment of the drivers of deforestation in

the specific country/region and by the timely delivery of information on the dynamics of deforestation and forestry activity to all stakeholders. It is crucial, for example, to acknowledge that the perception of the value of forests in tropical countries varies according to the importance of the forestry sector in local economies. The drivers of deforestation are a reflection of the greater economic gain presented by competing economic activities, namely agriculture and cattle ranching, over conservation.

Summing up, a successful REDD+ strategy should not only encompass improvement of monitoring and enforcement, but also policies to enhance capacity in the sustainable use of forests and to increase the value of forest production and protection when compared to alternative uses of the land. In this regard, an effective and sustainable REDD+ can only be ensured if forests are considered in their multiple dimensions. REDD+ is about reducing carbon emissions and mitigation of climate change, but can also be a tool to trigger investments in forests. REDD+ can deliver the dual benefit of raising funds for emissions reduction and promoting conservation and the sustainable use of forests while simultaneously addressing governance, co-benefits and sustainability issues.

REDD+ development in the Brazilian Amazon

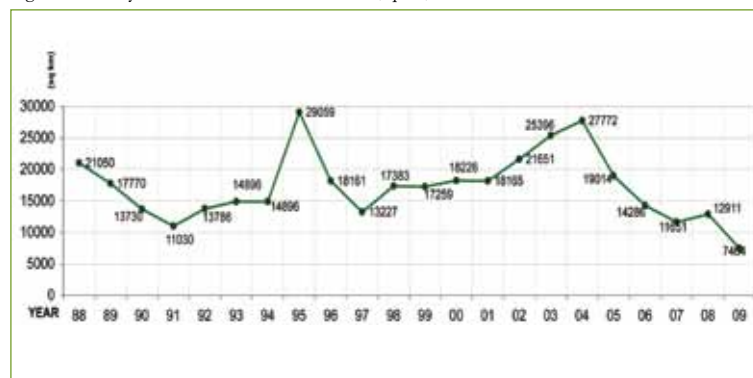
The legally-defined Brazilian Amazon encompasses an area of over 5 million km² – a land mass larger than that of the 27 countries of the European Union combined – and corresponds to some 60 per cent of Brazil's total territory. The entire Amazon basin, from its source in the Peruvian Andes until its estuary in the Atlantic, totals 6.9 million km². It also shelters strategic natural resources, such as the world's largest freshwater reserve, a number of valuable ores, such as diamond, gold, and nickel, and the world's richest region in terms of biodiversity. It also has a unique role in the carbon cycle and rain distribution in the two hemispheres. Safeguarding this vast megadiverse region on which the health of the planet depends is a mammoth task, not only for Brazil, but for all Amazonian countries.

The challenge to balance environmental conservation with economic development needs grows even more complex when we consider that the Brazilian side alone is populated by over 25 million people with legitimate demands for jobs, income, health, education, sanitation and transport. Their needs do not always receive the same international attention as the region's vast ecological reserves.

A good deal of this Amazonian population is a result of government-induced migration from the 1960s to 1980s. The motto in Brazil at the time was "to give land to the landless" and immigrants from the south-central and northeastern regions arrived looking to establish the same type of agriculture as they had in their homelands. In order to prove land tenure, they were encouraged to cut the forest and clear the areas through 'slash and burn', which often resulted in uncontrollable forest fires.

The average deforestation rate in the Brazilian Amazon up to 2004 was around 2 million hectares per year. In 2004, after hitting a deforestation peak of 2.7 million hectares, a taskforce involving 11 ministries was commissioned by the Brazilian President which

Figure 1: History of deforestation in the Amazon (sq km).



established a Plan to Prevent and Control Deforestation in the Amazon (also known as PPCDAM). The plan began implementing its 144 actions in 2005. Since then, deforestation has been decreasing rapidly: 1.8 million ha in 2005; 1.4 million ha in 2006; 1.2 million ha in 2007 and 2008; and 0.7 million ha in 2009. For 2010, the figure is predicted to be even lower.

The Amazon Fund

The first three years of PPCDAM implementation brought CO₂ emissions savings of over 1 billion tonnes. These results were the inspiration for the creation of the Amazon Fund in 2008.

The Amazon Fund pools donations made to protect the rainforest. It funds non-refundable prevention actions including forest monitoring, the promotion of conservation and the sustainable use of the Amazon biome. The Fund has a technical board and a guidance board which together guarantee information integrity on emissions data and align the Fund's priorities with the interests of the multiple stakeholders involved in the fight against deforestation.

The Amazon Fund began operations in April 2009, after the first contribution was made by Norway. From April to December 2009, five projects were approved. The expectation for 2010 is that the Fund might approve another 20 projects. The confirmation of future contributions from Norway for 2010 and 2011 has enabled the Fund to assess more ambitious projects. The Amazon Fund is recognised as the world's first large-scale financial instrument for REDD+, as it receives funds based on estimates of reducing emissions from deforestation already obtained in Brazil.

In its national CO₂ emissions targets, Brazil has included a target of reducing emissions from deforestation in the Amazon by 80 per cent by 2020, from the average annual deforestation rate between 1996–2005.

Beyond the Amazon: tackling deforestation across Brazil

In the past few years, policies to fight deforestation in the Amazon have brought tangible results. However, deforestation in the Cerrado biome is still a concern. In order to fight it, an Action Plan to Prevent and Control Deforestation in the Cerrado was established in 2009, following the lines of PPCDAM. The Plan's goals include; reduction of greenhouse gas (GHG) emissions

from deforestation in the Cerrado by 40 per cent by 2020, in comparison with historical data.

By the end of 2010, the ecologically important Caatinga, Pampa and Pantanal biomes will also have their deforested areas monitored and Plans for these biomes are on the horizon.

We are committed to the establishment of a national REDD+ legal framework that sets forth rules to preserve climate systems and biodiversity, that values standing forests and respects and includes local populations. The discussion process on the REDD+ national strategy involves several relevant stakeholders and includes topics like financing, social and environmental safeguards, responsibility, internal benefit sharing and monitoring and communication systems.

The national REDD+ regime must be valid for all biomes and establish reference levels of forest cover and national forest emission rates per biome. Brazil, drawing on its experience with current monitoring systems in the Amazon, must build other robust systems for the other biomes.

As part of its work to develop a robust monitoring, reporting and verification system (MRV), Brazil is also investing in tools to estimate forest biomass and terrestrial carbon, primarily through the national forest inventory.

Brazil's national climate change strategy

Alongside the ongoing fight against deforestation, other important steps have been taken in the last few years in Brazil's policies to fight climate change, including the Climate National Plan, Climate Fund and the National Policy on Climate Change.

The National Policy on Climate Change, passed at National Congress in December 2009, defines emission reduction goals for Brazil – between 36.1 and 38.9 per cent based on projected emissions levels for 2020 – and develops Sectorial Plans for emissions reduction and adaptation, among other aspects. The policy is currently at the regulation stage.

The Climate Fund was created in late 2009. It provides Brazil with an effective instrument to tackle climate change in every dimension, including mitigation and adaptation actions within a strategic low-carbon development conception. Resources for the Fund come from a profit-sharing initiative within the productive oil chain.

The Climate Fund will go towards supporting several mitigation and adaptation activities, including the fight against desertification, environmental education and capacity-building projects, REDD+ projects, technology development and dissemination, public policies formulation, sustainable productive chain support, environmental services payments and others.

For 2011, some R\$200 million (US\$117 million) of refundable resources and some R\$26 million (US\$15.2 million) of non-refundable grants have been approved. Regulation of the Climate Fund is being prepared and the management board must be established before the end of 2010.

At the international level, we defend an efficient climate change regime that creates objective conditions to ensure global warming does not exceed 2°C above pre-

industrial times, but one that is also fair and equitable, protecting vulnerable populations from the consequences of climate change. This regime needs to create conditions for sustainable development that does not replicate the richest countries' unsustainable production and consumption standards.

A greener future for Brazil

In recognising the historical responsibility of developed countries, Brazil is not advocating a less active role for itself. We understand we are part of the solution, and along these lines, President Lula presented our voluntary commitments to reduce emissions between 36.1 and 38.9 per cent in relation to projections made for 2020 in Copenhagen last year.

Brazil has very specific characteristics that should guide policies to tackle climate change. The countries emissions come from deforestation and unsustainable land use, but the fight against climate change is not restricted to fighting deforestation emissions.

In the energy sector, the great challenge is to maintain the energy matrix with a high percentage of renewable energies, currently at around 46 per cent. In order to achieve that, we must invest in renewable sources and energy efficiency, the two key objectives of the National Policy on Climate Change.

In the agricultural and steel sectors several projects are underway, looking for opportunities to fight climate change while promoting good practice and contributing to sustainable development. Actions include substitution of charcoal sourced in deforested areas for charcoal from managed forests, direct recovery of pastures, integration between agriculture and animal husbandry, zero tillage and biological fixation of nitrogen. These actions directly and indirectly work to reduce deforestation.

Brazil's development in this century is highly dependant on its strategic view in relation to renewable sources, ecological alternatives, and its urban, rural and forest development standards. A low-carbon economy will consolidate our recent achievements and increase our potential for further green development.

Izabella Teixeira is Minister of Environment for Brazil. Prior to taking office in April 2010, she was Executive Secretary for the former environment minister, Carlos Minc. She has served as Director of the national government's environmental enforcement agency, the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA). She has a master's in Energy Planning, a PhD in Environmental Planning and is internationally recognised as an expert on strategic environmental assessment.

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Forests in developing countries are being cleared at a rapid pace for many reasons.



Dr Charlotte Streck
Director of Climate Focus

How climate change can catalyse sustainable land management

In land-use policies, particularly forestry and agriculture, climate change mitigation, food security and poverty reduction come together. Collectively, deforestation and agricultural practices are responsible for an estimated 30 per cent of global greenhouse gas (GHG) emissions. By contrast, environmentally responsible forest and agricultural management can offset emissions by absorbing CO₂ from the atmosphere. Adopting sustainable land-use practices is a valid, and in many cases cost-effective, mitigation strategy that often comes in tandem with significant adaptation, livelihood and biodiversity benefits.

Despite the potential of the land-use sector in mitigating climate change, the international climate regime so far does not create many incentives to tap into this opportunity. The UN Framework Convention on Climate Change (UNFCCC) recognises that all sinks and reservoirs of GHGs have an important impact on terrestrial and marine ecosystems. The Convention's objective to stabilise GHG concentrations in the atmosphere "at a level that would prevent dangerous anthropogenic interference with the climate system" should be tackled, at least in part, by exploiting the capacity of sinks to reduce GHG concentrations.

Under the rules of the Kyoto Protocol, developed countries may use direct human-induced changes in GHG emissions and removals by sinks since 1990 as part of their emission reduction targets. Developed countries must account for changes in forest carbon stocks and report some agricultural emissions (mainly methane and nitrous oxide emissions from human-induced biological processes). Others are optional, such as CO₂ removal from cropland management.

The Protocol's Clean Development Mechanism (CDM) offers incentives for mitigation of land-use-

related emissions in developing countries through manure and waste water management, as well as afforestation and reforestation. But neither the UNFCCC nor the Kyoto Protocol has provided incentives for reduced emissions from deforestation or the enhancement of carbon stocks through soil carbon sequestration in developing countries.

However, there are signs that things may change. Over the last few years, the contribution of land-use practices to global climate change has garnered increasing attention in international climate negotiations. The primary focus rests on strategies and incentive mechanisms that reduce emissions from deforestation and forest degradation (REDD), with a mitigation potential of 4.3 gigatonnes of CO₂ equivalent (GtCO₂e) by 2020. Another 1.5 GtCO₂e could potentially be abated in the form of carbon captured by existing and newly planted forests as well as 1.9 GtCO₂e sequestered by more sustainable agricultural practices (Project Catalyst, 2009) (jointly referred to as REDD+).

At COP 11 in Montreal in 2005, developing countries tabled a motion indicating they were prepared to reduce emissions from deforestation provided appropriate incentives were put in place. That motion triggered intense negotiations under the UNFCCC and the establishment of various initiatives to build capacity and develop REDD+ demonstration projects.

In recent years, political momentum to address emissions from agriculture has also grown. As global food production is expected to double by 2050, GHG emissions from the sector must be stabilised to achieve emission targets advocated by the Intergovernmental Panel on Climate Change (IPCC). At the same time, climate change will depress agricultural yields making adaptation one of the main challenges of the agricultural sector. Well-designed policies at the national and

international level can catalyse strategic investments in the sustainable agricultural research and practices necessary to increase agricultural productivity, reduce pressure on forests, and conserve water tables, biodiversity and soil functions.

The opportunity for sustainable agriculture

The land-use sector is characterised by an overlapping set of interests determined by agriculture, forestry, infrastructure, settlement, and industry. Climate change affects these interests by influencing soil fertility, water resources and biomass accumulation through shifting and more extreme weather patterns. Many of these impacts, such as increased land degradation and soil erosion, changes in water availability, biodiversity loss, more frequent pest and disease outbreaks as well as natural disasters need to be addressed across sectors (Food and Agriculture Organization (FAO) 2008). While carbon dioxide emissions from agriculture are small, the sector accounts for about 60 per cent of all nitrous oxide and about half of all methane emitted, mainly from soils and enteric fermentation.

There is evidence that adaptation, mitigation and food security enhancement and rural development can go hand in hand. Unlike other sectors, adequate agriculture and forestry strategies can simultaneously increase adaptive capacity and mitigate climate change (FAO 2008). For example, increasing soil organic matter in cropping systems, agroforestry and mixed-species forestry can improve soil fertility and soil moisture holding capacity, reduce impact of droughts or floods, reduce vulnerability and sequester carbon.

Getting ready for REDD+

Over the last year, developed countries have pledged about US\$5 billion in fast-track finance for REDD+. Additional fast-track funding in the order of US\$30 billion has been announced. The availability of funds as well as the commitment to address emissions from forestry under a REDD+ incentive mechanism and to promote agricultural mitigation strategies as Nationally Appropriate Mitigation Actions (NAMAs) in developing countries create an opportunity to develop international and national policies. Such policies, if well designed, support the move to a sustainable and integrated land-planning that takes into account climate change adaptation needs while promoting GHG emission reductions.

The Copenhagen Accord, drafted in the final hours of the COP 15 last year, encourages developed country Parties of the UNFCCC to notify the Convention secretariat of economy-wide emission reduction targets. Developing country Parties are invited to notify the secretariat of NAMAs that they intend to adopt and implement. Out of the 43 developing countries which had submitted NAMA information by October 2010, at least 20 included mitigation plans for the agricultural sector.

Brazil quantified emission reduction commitments through increased restoration and conservation, improved livestock management, conservation tillage and nitrogen-fixing activities. Ethiopia specified an area where cropland-related mitigation practices will be adopted.

Although most countries did not quantify their efforts, they indicated that they will engage in a number of agricultural mitigation activities.

At the same time more than 40 tropical countries have engaged to build the capacity and institutions to participate in an international REDD+ mechanism, even before such mechanism has been formally adopted. Brazil, the Democratic Republic of Congo, Indonesia, among others, have signed bilateral partnership agreements with the Government of Norway under which Norway provides performance-based resources for REDD+. The support of the World Bank's Forest Carbon Partnership Facility (FCPF) and UN-REDD enabled Guyana, Panama, Indonesia and other countries to begin REDD+ capacity building at the national and the sub-national level in 2009.

Participating countries have started to engage in REDD+ readiness, a process that entails defining national REDD+ strategies, public consultations, and the establishment of measuring, reporting and verification (MRV) systems. The readiness process demands that countries assess drivers of deforestation and carefully evaluate options to reduce emissions and build national consensus through cabinet level and stakeholder consultations.

In most countries the most efficient REDD+ strategies lie outside of the forestry sector. Global and local demand for agricultural products such as food, feed, and fuel is a major driver of cropland and pasture expansion across much of the developing world. Whether these new agricultural lands replace forests, degraded forests, or grasslands greatly influences the environmental consequences of expansion.

Forests in developing countries are being cleared at a rapid pace for many reasons but largely for the expansion of agricultural lands. Clearing forest land for cattle pasture is the largest driver of deforestation in the Amazon, accounting for more than two-thirds of annual forest clearing in most years (FAO 2010). Consequently, conservation of forests has to be supported through changed agricultural, fiscal and infrastructure policies. Without any doubt, of the most important REDD+ strategies in developing countries is agricultural intensification. Without increased crop and livestock yields per hectare, pressure on land resources will accelerate as crop and pasture areas expand under extensive production. Intensification, however, should not follow the developed country model where it is often based on the specialisation of farms in a particular crop or animal and on the intensive use of agrochemicals (World Bank, World Development Report (WDR) 2010). Sustainable and climate-smart agriculture will, nevertheless, require diverse income sources, production choices and genetic material.

Integrated land management

The multiple goals of achieving food security, protecting water and biodiversity resources, adapting to climate change and reducing emissions can only be achieved through strategic and adaptive land management. The various preparatory and consultative processes triggered by international discussions and national strategies around climate change adaptation and mitigation hold the potential to move countries towards the sustainable and integrated management of the various functions that land has to serve.

Such integrated management makes it possible to intensify agriculture, manage water resources and improve social and economic development while protecting biodiversity and soil functions, and reducing GHG emissions.

Participatory consultation

Multilateral, bilateral and unilateral REDD+ readiness initiatives, the identification and formulation of agricultural NAMAs, the definition of national adaptation strategies and efforts to secure stable food supply can all help catalyse the alignment of various land-use policies into national, integrated strategies. Emerging international incentive mechanisms – in particular performance-based financing linked to NAMAs and REDD+ and financial support for adaptation measures – must be coordinated with existing policies on food security to ensure that intensification of agriculture promotes climate-resilient and environmentally sound farming practices.

The consultative processes triggered by new and innovative climate-related financial mechanisms are an opportunity to instate integrated land-planning in developing countries as a condition for REDD+ and sustainable food production. REDD+ readiness and the elaboration of NAMAs are essential steps towards low carbon development.

Given that the land-use sector provides income for more than a third of the world's workforce, it is essential that any strategy is supported by a broad range of stakeholders, including decision-makers, land-management planners, land users, landowners, and beneficiaries of land services. Consultations are vital to identify their requirements and needs. Relevant physical, social and economic conditions and data on land units need to be made available to stakeholders to ensure that they are able to provide informed input into the development of policies. Once strategies and policies have been appraised and cost and benefits of each have been assessed, governments need to establish the institutional and legislative infrastructure needed to implement the agreed-upon land uses and long-term land management. Such infrastructure includes clarification of land titles and tenure reform; it also entails to establish institutions that integrate relevant information and manage land-planning systems.

International policy processes and bilateral cooperation can support such national process through

- **Financial support:** International incentive mechanisms for mitigation (NAMAs, REDD+) and for adaptation can be bundled with financing for food security and private sector investments into the land-use sector.
- **Information and learning:** The performance-based nature of funding for climate change mitigation facilitates the establishment of national (and/or international) performance checks and MRV systems. The resulting information ensures transparency of the policies and measures towards stakeholders.
- **Capacity building and institutional strengthening:** REDD+ readiness and NAMA development must progress alongside a strengthening of national institutions and processes, including law enforcement and tenure reform.

- **Stakeholder involvement:** Land-use planning must be collaborative in approach, involving local governments, indigenous and local groups, NGOs and the private sector. The resulting land-use plans must guide decision-making. The REDD+ process and its requirements may be a good starting point for national consultations on low-emissions solutions for the forestry and agriculture sector.

Outlook

While a legally-binding agreement in line with the overall objective to avoid global temperatures rising by more than two degrees may take several years more to negotiate, climate change action is already taking place. International mechanisms, even before adopted (REDD+) or even defined (NAMAs), trigger anticipatory action. Readiness processes integrated in the development of low carbon development strategies are likely to continue and receive support through bilateral or multilateral cooperation. As long as such processes are coordinated and informed by consultations and stakeholder involvement, they have the potential to facilitate long-term change in national strategies.

The land-use sector is one of the most prominent examples where integration is essential for further success. Only if the walls between adaptation and mitigation projects fall, only if food security and water management are taken into the equation, can the longer term carrying capacity and health of our land be secured.

Charlotte Streck is Director of Climate Focus and a former senior counsel for the World Bank in Washington, DC. She has been actively involved in climate change policy throughout her career and helped establish several of the World Bank's carbon funds. She is an advisor to numerous governments, private companies and non-profit organisations and is actively involved in the debate around the development of new carbon finance mechanisms. She is also lead counsel for climate change with the Center for International Sustainable Development Law with McGill University and an adviser to the Prince of Wales Rainforest Project.

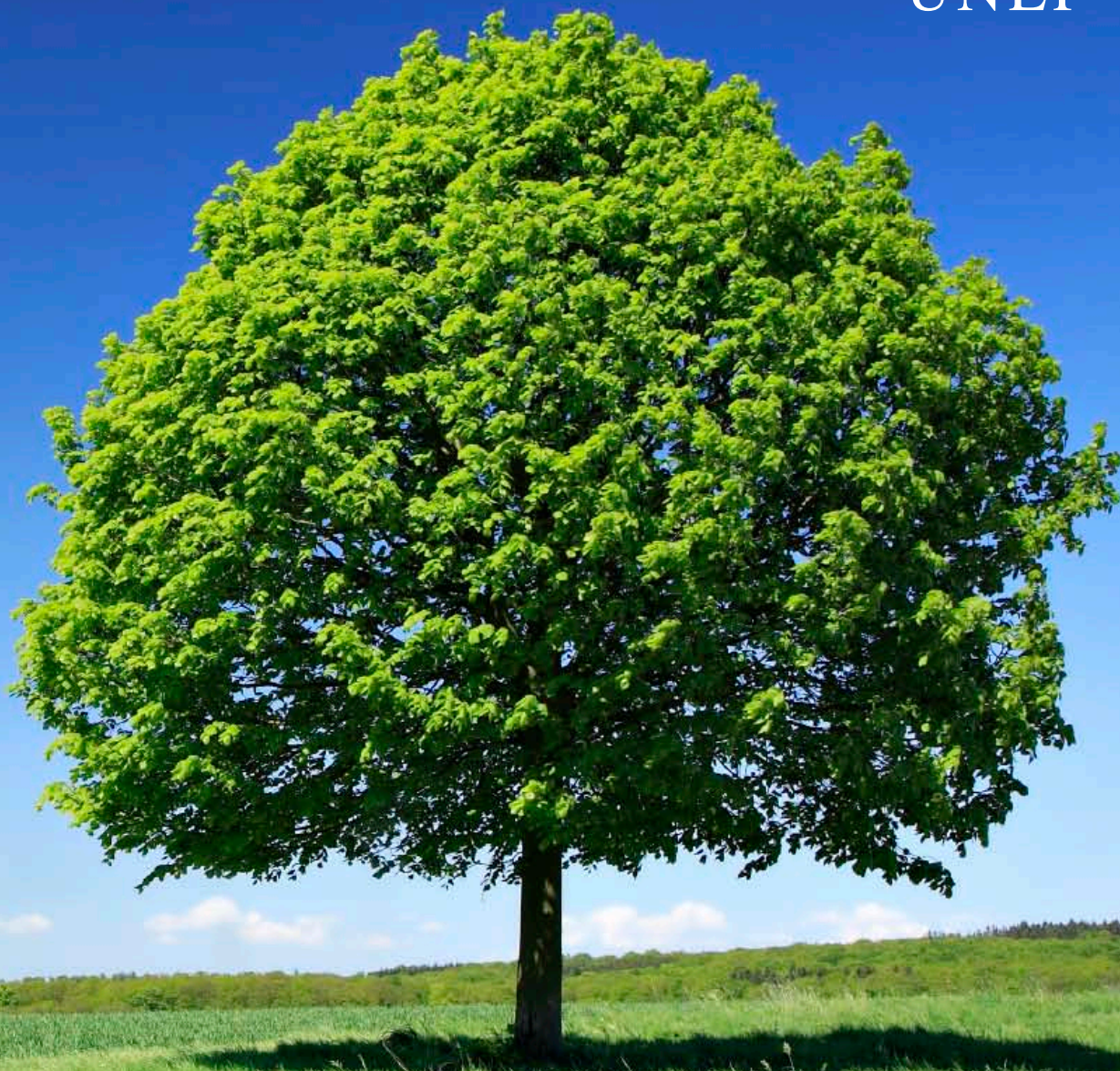
Climate Focus works closely with companies, governments and non-governmental organisations on reducing emissions in energy, households, industry, agriculture and forestry. With experts in national and international climate law, emissions trading, project design and finance, multidisciplinary teams develop custom solutions for clients, ranging from the development of policies to protect the rainforest to structuring greenhouse gas mitigation projects in the energy sector.

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Some call it a tree



© Istock Photos



UNEP also calls it carbon capture and storage
UNEP AND CLIMATE CHANGE: INVEST IN THE GREEN ECONOMY



Biodiversity: the essence of forest goods and services



Frances Seymour, Director-General of Center for International Forestry Research (CIFOR)

Robert Nasi, Principal Scientist and

Terry Sunderland, Senior Scientist, for CIFOR

As well as providing humanity with a wealth of goods and environmental services, the world's forests also play a newly appreciated role in mitigating climate change through carbon sequestration and buffering communities and ecosystems from the full impacts of extreme weather events. Biodiversity is at the core of all these services. Any new model of forest conservation must have biodiversity at its heart and work to protect the whole gamut of goods and services essential for local livelihoods and for the wellbeing of society at large.

The bounty provided by forests

Forest resources are essential to the daily lives of about a billion people worldwide. In many developing countries, forest-based enterprises provide at least a third of all rural non-farm employment. Forests provide timber for construction of houses and boats, and fuelwood or charcoal for cooking or heating homes. In sub-Saharan Africa, most rural energy needs are supplied by forests. Forests also provide a wide variety of non-timber forest products such as medicinal plants, honey, gums and resins, wild fruits and nuts, rattan, mushrooms and wild meat. Households located near forests in tropical countries typically derive about a quarter of their income from forest products.

In rural areas of the Congo Basin, many communities depend on wild meat for up to 80 per cent of the fats and proteins in their diets. In areas where fish are an important source of protein, forests, especially mangroves, support the healthy aquatic ecosystems necessary to maintain fish stocks. Fats sourced from oil palms are essential to rural diets in West and Central Africa, while starch from the sago palm is consumed on a regular basis by a million people across south-east Asia and the south-west Pacific.

Access to food and other products from the forest are especially important for vulnerable groups and in times of stress. Many people around the world rely on forest-based medicines as a first recourse for health problems. Forests are a particularly important source of income and employment for women. Women often derive income from the processing and marketing of non-timber forest products and are able to combine forest-related craft-making with other household responsibilities. Indigenous communities in East Kalimantan, Indonesia have documented 3,642 specific uses for 1,449 species of forest plants and animals, and of these 119 had no known substitute for the particular use.

Forests provide services, too

Forests provide especially important services to the agriculture sector. They offer a source and a reservoir of genetic diversity for many of the world's important agricultural crops. Cassava, banana and plantains, cocoa, oil palm, coffee, rubber and most livestock species have their origin in forest ecosystems, and still have wild relatives there. Genes from wild relatives can often be useful in breeding resistance to pests and disease and to other sources of stress such as drought which will become increasingly important in a changing climate.

Agricultural productivity is enhanced when forests and trees are maintained in and around farms. Forest cover provides natural protection to crops and livestock by providing shade, wind breaks, mitigating floods and aiding the control of pests. Biologically diverse forest ecosystems support birdlife, beneficial insects and spiders, as well as fungi, bacteria and viruses which all consume or control pests, reducing the need for farmers to use commercial

pesticides. In Costa Rica, plantation owners and farmers have paid for the conservation of neighbouring forest for the natural pest control they provide.

In addition, up to 35 per cent of the world's agricultural crops rely on pollinators for production, including forest species of bats and honey bees. For example, coffee cultivated in the fields furthest away from forested areas has been shown to have lower yields due to reduced pollination services. In addition, forests support the conservation of soil and water needed for sustainable agriculture, as trees can provide nutrients from leaf litter and also reduce the erosion of nutrient-rich top soil. Maintenance of natural forest cover can help control erosion which reduces water quality and the lifespan of irrigation infrastructure.

At broader scales, forests are often central to maintaining water security. Forested catchments are a vital source of freshwater for human use, supplying an estimated 75 per cent of usable water globally. Recent studies show that the conversion of forests to pastures in Brazil may affect rainfall levels at the regional scale due to reduced evapotranspiration with significant implications for agricultural production.

The risks posed by deforestation and degradation

Unfortunately, these flows of forest goods and services are undermined or lost altogether when forests are converted to other uses or degraded through unsustainable use. According to the UN Food and Agriculture Organization (FAO), the world's area of tropical forests has continued to shrink by 13 million hectares per year over the last decade. The conversion of forested land to agricultural crops, pasture, and plantations is the principle driver of forest loss, aided by the intrusion of transport, mining and other infrastructure.

Competition for land to produce food, fibre and bioenergy has increased the pressure to convert natural forests to other uses. Even when already-deforested land is available for such purposes, governance failures drive smallholders and commercial-scale investors alike to open up relatively undisturbed forest land instead. Perverse incentives may be created by conflicting ownership claims on lands that have already been cleared, poor law enforcement in remote areas and/or windfall profits available from clearing standing timber on forested land prior to replanting with another commercial crop.

Keeping forests as forests is the best way to maintain their biodiversity. Even logged-over forests are much better for conserving biodiversity than the land-uses that often replace them, especially when they are adjacent to intact or old-growth forests. And there are many practical steps that can be taken to minimise the impact of timber extraction on forest ecosystems. For example, the most important impacts of logging on wildlife are often due to the increased hunting pressure and habitat fragmentation caused by associated road-building. Better regulation of hunting, reducing the width of roads and maintaining biological corridors can go a long way towards mitigating such impacts.

In addition, a switch to reduced impact logging (RIL) could significantly decrease the impacts of timber

extraction on both wildlife and carbon emissions. Inefficient and wasteful logging practices leave some 20 per cent of the volume of harvestable timber on the forest floor to rot or fuel forest fires.

What we risk by depleting wildlife

One form of forest degradation – the depletion of wildlife or 'defaunation' through hunting – is a particularly insidious threat to the sustainability of forest goods and services. When logging and mining are poorly regulated, increased access to the forest can transform what was formerly a sustainable subsistence activity into an unsustainable commercial one. As a result, forests can be depleted of their wildlife, with important implications for both human livelihoods and ecological sustainability. Wild meat is an important component of the diets of many rural communities in terms of both nutritional needs and cultural preference. The extirpation (local extinction) of species can thus threaten human health and culture.

But survival of the forest itself also depends on maintaining biodiversity. Individual species and combinations of species play complex roles in sustaining others. Forest fauna may also play key roles in the pollination or seed dispersal necessary for the regeneration of trees and other plants. For example, ungulates such as wild pigs and antelopes are active seed dispersers and predators, and their absence can have a significant impact on forest regeneration and other ecosystem dynamics.

Wildlife grazing on plants or preying on other species is often necessary to maintain species diversity, maintain food chains and control pests. For example, large herbivores such as elephants have a huge impact on forest vegetation structure, influencing the relative abundance of plant and other animal species. The loss of such 'keystone species' can have a disproportionate impact on the structure and composition of the ecosystem. Large animals and top predators, such as large cats or crocodiles, tend to be both keystone species and the preferred target of hunters. Local extinction of such species caused by uncontrolled hunting can thus result in significant loss of forest function, even if the trees are left standing.

Forests are vulnerable to climate change

Forests have an important role to play in helping societies adapt to climate change. Natural forests can help maintain the quantity and quality of surface water flows for drinking water and agricultural uses, even as rainfall patterns change. They can also increase the resilience of rural communities by providing a back-up source of food and income when climate change induces crop failure or other loss of livelihood. Diverse forest ecosystems are especially valuable in the context of a changing climate because they provide a variety of goods and services that reduce vulnerability to disruption in any particular source of income.

It is also critical to recognise that forest ecosystems themselves are threatened by climate change. Forests are vulnerable to many of the predicted effects of global warming. For example, increased average temperatures and longer dry seasons are likely to combine to increase the incidence and severity of forest fires such as those experienced in Russia in mid-2010.

Increased average temperatures and milder winters in temperate and boreal zones will likely increase the range of forest pests such as the pine bark beetle that has decimated large areas of Canada's spruce forests. Forests are also vulnerable to the extreme weather events that are predicted to increase in frequency and severity with climate change. For example, in 2007, Hurricane Felix flattened swaths of tropical forest in Nicaragua.

Tree species with limited distributions are particularly ill-equipped to adapt to a rapidly changing climate. The pace of global warming is likely to outstrip the ability of tree species to migrate to newly-created habitats at different latitudes and altitudes as climate change advances. Perhaps most alarming is the possibility of large-scale conversions of ecosystems that could be induced by global warming exacerbated by human activity. Some models suggest that the humid forests of the Amazon basin could be gradually converted to savannah grasslands through repeated cycles of drying and burning.

For all of these reasons, forests need to be included in national adaptation strategies, both as a sector that can help other sectors adapt, as well as a sector in need of adaptation assistance in its own right. As a general principle, any measures that preserve the integrity of forest ecosystems will improve their ability to adapt to climate change.

Maintenance of genetic diversity – both within and between species – will also serve to increase the options for adaptation. Specific forest management interventions can include use of reduced impact logging techniques, fire prevention, and silvicultural practices that support conservation of the genetic diversity of forest species.

Forest management: not just a question of carbon

The newly appreciated role of forests in the mitigation of climate change has generated a new constellation of funding and political attention at national and global levels. Initiatives under the rubric of Reducing Emissions from Deforestation and forest Degradation in developing countries (REDD+) are now dominating global discussions of forest management. The overall impact of such initiatives on the conservation of forest biodiversity is likely to be positive in that maintaining forests as forests serves both climate change mitigation and biodiversity conservation objectives. However, the extent of those co-benefits, and the management of some associated risks, will depend on the design specifics of the REDD+ interventions.

One risk is that managing forests for carbon alone will simply displace deforestation and degradation pressures to other forest areas that might be relatively carbon-poor but also relatively species-rich. Efforts to control such 'leakage' at national and international levels are thus a critical component of REDD+ strategies. Another risk is that, depending on how forests are defined, biodiverse natural forests or other ecosystems such as savannahs could be replaced with monoculture plantations. REDD+ interventions could also result in impoverishment of local incomes if local people's access to forest resources is restricted and rights to share in REDD+ benefits not respected. Accordingly, REDD+ strategies must be accompanied by the rigorous enforcement of social and environmental safeguards.

Biodiversity is the essence of the many benefits provided by forests. The continued supply of products – from fuelwood to timber to bushmeat – and sustained provision of the less-appreciated ecosystem services, such as carbon sequestration, pollination and hydrological regulation, depend on the complex web of species that constitute a forest. Forests are threatened by deforestation and degradation, defaunation, and climate change. Properly designed REDD+ initiatives can ensure that forests serve both mitigation and adaptation objectives, conserve biodiversity and its multiple benefits by providing incentives to maintain forests as forests.

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CIFOR is a nonprofit, global facility dedicated to advancing human wellbeing, environmental conservation and equity. We conduct research that enables more informed and equitable decision making about the use and management of forests in less-developed countries. Our research and expert analysis help policy makers and practitioners shape effective policy, improve the management of tropical forests and address the needs and perspectives of people who depend on forests for their livelihoods. Our multidisciplinary approach considers the underlying drivers of deforestation and degradation which often lie outside the forestry sector: forces such as agriculture, infrastructure development, trade and investment policies and law enforcement.

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A farmer ploughs through hardened soil on a rain dependent rice field.



Climate change, biodiversity loss, water stress – the case for sustainable agriculture



Professor Robert Watson
Chief Scientific Adviser to the UK government
Department for Environment, Food and Rural
Affairs (Defra) and Strategic Director of the
Tyndall Centre, University of East Anglia

The Earth's environment is changing on all scales from local to global, in large measure due to human activities. The climate is warming and biodiversity is being lost at an unprecedented rate. Fisheries are in decline in most of the world's oceans, increasing populations live in areas that are water stressed or water scarce, and large areas of land are being degraded. It is the developing world that will be hardest hit by these changes. According to Professor Watson, we need a radical shift in our methods of production and use of energy, water, food and other biological resources if we are to leave a functioning planet behind for future generations.

The issues of climate change, loss of biodiversity and degradation of ecosystem services are interconnected and are undermining economic growth, poverty alleviation, and the livelihoods of the poor; human health; and personal, national, and regional security, and worse, the future projected changes in the environment are likely to have even more severe consequences. Developing countries and poor people in developing countries are the most vulnerable, and the actions of today will affect future generations.

The major indirect drivers of change are primarily demographic, economic, sociopolitical, technological, and cultural. These drivers are clearly changing: the world's population and the global economy are growing, the world is becoming more interdependent, and there are major technological and behavioural changes. For climate change, these largely manifest themselves in increased demand for energy and changes in land-use (e.g. deforestation), and for biodiversity and

ecosystem degradation, in conversion of natural habitats, overexploitation of natural resources, invasive species, pollution (sulphur, nitrogen and phosphorus), and human-induced climate change itself.

A warming planet

There is no doubt that the composition of the atmosphere and the Earth's climate have changed since the industrial revolution, predominantly due to human activities and it is inevitable that these changes will continue regionally and globally. Global mean surface temperatures have already increased by about 0.75°C, and are projected to increase by an additional 1.2-6.4°C between 2000 and 2100, with land areas warming more than the oceans and with the high latitudes warming more than the tropics. Precipitation is likely to increase at high latitudes and in the tropics, and decrease significantly in the sub-tropics.

Changes in temperature and precipitation are causing other changes including; rising sea levels, retreating mountain glaciers, melting of the Greenland ice cap, shrinking Arctic Sea ice, (especially in summer), increasing frequency of extreme weather events such as heat waves, floods, and droughts, and the intensification of cyclonic events, such as hurricanes in the Atlantic.

The Earth's climate is projected to adversely affect freshwater, food supply, natural ecosystems, coastal systems and low-lying areas, human health and social systems. Temperature increases, which will increase the thermal growing season at temperate latitudes, are likely lead to increased agricultural productivity for temperature changes below 2-3°C, but decrease with larger changes. However, agricultural productivity will

likely be negatively impacted for almost any changes in climate throughout the tropics and sub-tropics, areas with high levels of hunger and malnutrition. Climate change will likely exacerbate biodiversity loss and adversely affect most ecological systems, especially coral reefs, potentially resulting in significant adverse changes in ecosystem goods and services. Water availability and quality in many arid- and semi-arid regions is likely to decrease, while the risk of floods and droughts in many regions will increase. These climate change impacts are most likely to adversely affect populations in developing countries. Climate change, coupled with other stresses, can lead to local and regional conflict and migration depending on the social, economic, and political circumstances.

Loss of biodiversity and degradation of ecosystem services

Biodiversity is central to human wellbeing, providing a variety of ecosystem services that humankind relies on, including: provisioning (e.g. food, freshwater, fibre and fuel); regulating (e.g. of climate, floods and diseases); culture (e.g. aesthetic, spiritual, educational and recreational), and supporting (e.g. nutrient cycling, soil formation and primary production). These ecosystem services contribute to human wellbeing, including our security, health, social relations, and freedom of choice and action.

Enhancement of the goods and services provided by ecosystems tend to have multiple and synergistic benefits, but little of this potential is being used today. Indeed, throughout the world, the capability of many ecosystems to provide a range of services is being diminished, because of conversion of natural habitats, over-exploitation, pollution, introduction of exotic species and climate change, which are in some instances causing tremendous harm to both people and the environment.

Biodiversity is central to human wellbeing, providing a variety of ecosystem services.

While climate change has not been a major cause of biodiversity loss over the last 100 years, it is likely to be a major threat in all biomes in the next 100 years. Ecosystems that are likely to be most threatened by climate change include coral reefs, mangroves and other coastal wetlands, remnant ecosystems, some ecosystems with restricted distribution and high latitude/high altitude ecosystems. A recent assessment estimated that every 1°C increase in global mean surface temperature up to 5°C would eventually result in a 10 per cent loss of species.

Addressing the issue of biodiversity and ecosystem services requires changing the economic background to decision-making. There is a need to: (i) make sure that the value of all ecosystem services, not just those bought and sold in the market, are taken into account when making decisions; (ii) remove subsidies to agriculture, fisheries, and energy that cause harm to people and the

environment; (iii) introduce payments to landowners in return for managing their lands in ways that protect ecosystem services, such as water quality and carbon storage, that are of value to society; and (iv) establish market mechanisms to reduce nutrient releases and carbon emissions in the most cost-effective way.

There is also a need to improve policy, planning, and management by integrating decision-making between different departments and sectors, as well as international institutions, to ensure that policies are focused on protection and sustainable use of ecosystems. It will require: (i) empowering marginalised groups to influence decisions affecting ecosystem services, and recognise in law local communities' ownership of natural resources; (ii) restoring degraded ecosystems and establishing additional protected areas, particularly in marine systems and providing greater financial and management support to those that already exist; and (iii) using all relevant forms of knowledge and information about ecosystems in decision-making, including the knowledge of local and indigenous groups.

Success will depend on influencing individual behaviour, thus it will be critical to provide access to information about ecosystems and decisions affecting their services, provide public education on why and how to reduce consumption of threatened ecosystem services, and by establishing reliable certification systems to give people the choice to buy sustainably harvested products. It will also be important to develop and use environment-friendly technologies, thus requiring investments in agricultural science and technology aimed at increasing food production with minimal harmful trade-offs.

Climate change and biodiversity – seeing the links

Biodiversity and climate change are inextricably linked: (i) biodiversity and associated ecosystem services are impacted by climate change; and (ii) biodiversity and ecosystem management can assist in mitigating and adapting to climate change;

Climate change is projected to affect all aspects of biodiversity from individuals and populations to species distributions and ecosystem composition: (i) directly, e.g. through increases in temperature, changes in precipitation (and in the case of marine systems changes in sea level etc); and (ii) indirectly, e.g. through climate changing the intensity and frequency of disturbances such as wildfires.

• Ecosystem-Based Climate Change Mitigation

Ecosystem management can contribute to mitigating climate change by reducing greenhouse gas emissions or by enhancing the sequestration of carbon, while also maintaining biodiversity and ecosystem services. E.g. (i) protection of natural forest and peat-land carbon stocks; (ii) sustainable management of forests; (iii) use of native assemblages of forest species in reforestation activities; (iv) sustainable wetland management and restoration of degraded wetlands; and (v) some sustainable agricultural practices.

• Ecosystem-Based Climate Change Adaptation

Ecosystem management can contribute to adaptation

Ecosystem based adaptation

to climate change, while also maintaining biodiversity and ecosystem services. E.g. (i) coastal defence through the maintenance and/or restoration of mangroves and other coastal wetlands to reduce coastal flooding and coastal erosion; (ii) sustainable management of upland wetlands and floodplains for maintenance of water flow and quality; (iii) conservation and restoration of forests to stabilise land slopes and regulate water flows; (iv) establishment of diverse agro-forestry systems to cope with increased risk from changed climatic conditions; and (v) conservation of agro-biodiversity to provide specific gene pools for crop and livestock adaptation to climate change.

Food security and agricultural production

Total food production has nearly trebled since 1960, per capita production has increased by 30 per cent, and both food prices and the percentage of undernourished people have fallen. However, the benefits have been uneven and more than one billion people still go to bed hungry each night. Furthermore, intensive and extensive food production has caused environmental degradation.

☞ The demand for food is expected to double in the next 25-50 years, primarily in developing countries. ☞

Food prices have increased over the last three years for a variety of reasons that are unlikely to disappear in the coming decades, including: (i) poor harvests due to variable weather – possibly related to human-induced climate change; (ii) increased production of biofuels, e.g., maize in the USA; (iii) increased demand, in rapidly growing economies; (iv) high energy prices, increasing the cost of mechanisation and fertilisers; (v) speculation on the commodity markets at a time of low stocks; and (vi) export bans from some large exporting countries to protect domestic supplies.

The demand for food is expected to double in the next 25-50 years, primarily in developing countries. Furthermore, the type and nutritional quality of food demanded will change, e.g., increased demand for meat. We need sustained growth in the agricultural sector to feed the world, enhance rural livelihoods, and stimulate economic growth. Yet these new demands are arising at a time when – in addition to the challenges highlighted above – the world has less labour due to disease and rural-urban migration, less water due to competition from other sectors, land policy conflicts, loss of genetic, species, and ecosystem biodiversity, and increasing levels of air and water pollution.

Agriculture affects the environment. For example, tillage and irrigation methods can lead to salinisation and soil erosion, and fertilisers and other forms of agricultural production (e.g. rice production and livestock) contribute to greenhouse gas emissions, and extensification into

grasslands and forests leads to loss of biodiversity at the genetic, species and landscape level. Environmental degradation in turns reduces agricultural productivity.

We can no longer think of agriculture in terms of production alone. We must acknowledge the multi-functionality of agriculture, and place agriculture within a broad economic, social, and environmental framework. We can feed the world with affordable food while providing a viable income for the farmer, but business-as-usual will not work. Most of today's hunger problems can be addressed with the appropriate use of current technologies, particularly appropriate agro-ecological practices (e.g. no/low till, integrated pest management, and integrated natural resource management). These must be coupled with decreased post-harvest losses, including food wastage.

Emerging issues such as climate change and new plant and animal pests may increase our future need for higher productivity and may require advanced biotechnologies, including genetic modification, to address future food demands. However, the risks and benefits of these tools must be fully understood on a case-by-case basis. The public and private sectors should increase their investments in research and development, extension services, and weather and market information.

Farmers must be central to all initiatives taken; local and traditional knowledge must be integrated with agricultural knowledge, science, and technology developed in universities and government laboratories. Innovation that involves all relevant stakeholders along the complete food chain is essential. As such, we must recognise the critical role of women and empower them through education, property rights, and access to financing.

We will also need to employ global-scale policy reforms. This will include eliminating both OECD production subsidies and tariff escalation on processed products, and recognising the special needs of the least-developed countries through non-reciprocal market access. Governments should pay farmers to maintain and enhance ecosystem services.

Water security

Projections show that by 2025 over half of the world's population will live in places that are subject to severe water stress. This is irrespective of climate change, which will exacerbate the situation. Human-induced climate change is projected to decrease water quality and availability in many arid- and semi-arid regions and increase the threats posed by floods and droughts in most parts of the world. This will have far-reaching implications, including for agriculture: 70 per cent of all freshwater is currently used for irrigation. 15-35 per cent of irrigation water use already exceeds supply and is thus unsustainable.

Freshwater availability is spatially variable and scarce, particularly in many regions of Africa and Asia. Numerous dry regions, including many of the world's major 'food bowls', will likely become much drier even under medium levels of climate change. Glacier melt, which provides water for many developing countries, will likely exacerbate this problem over the long term. Runoff will decrease in many places due to increased

evapotranspiration. In contrast, more precipitation is likely to fall in many of the world's wetter regions. Developed regions and countries will also be affected.

Cost recovery for water – at only 20 per cent – poses a major problem for water management. Crucially, and controversially, we must get water pricing right. The Dublin Principles, created at an international conference in 1992 on freshwater security, should be implemented to help address the challenges associated with water scarcity. These include:

- (i) the **Ecological Principle** – river basin management (often transnational); multi-sectoral management (e.g. agriculture, industry, and households); and coupled land-and-water management;
- (ii) the **Institutional Principle** – comprehensive stakeholder involvement (e.g. state, private sector, and civil society – especially women) in management action at the lowest level;
- (iii) the **Instrument Principle** – improved allocation and quality enhancement via incentives and economic principles.

In summary, we are changing the Earth's climate, losing biodiversity and spending Earth's natural capital, putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted. However, the future is not pre-ordained. Business as usual will lead to an unsustainable world with significant changes in the Earth's climate and a loss of critical ecosystem services. Cost-effective energy and agricultural technologies, supported by appropriate policy frameworks, can lead to more sustainable practices.

Unless we act now to limit human-induced environmental degradation, history will judge us as having been complacent in the face of compelling scientific evidence.

A small improvement in resource efficiency is not enough – a radical shift is needed. Public and private sector decision-makers need to take a longer-term perspective. We must make advances in science and technology with the emphasis on interdisciplinary research. We must get the economics right; this includes eliminating perverse subsidies by valuing ecosystem services and internalising external factors.

Progress requires political will and moral leadership in the public and private sectors. The actions of today's generation will profoundly affect the Earth inherited by our children and future generations. Policymakers should recognise that there is no dichotomy between economic growth and environmental protection, and that addressing issues such as climate change, loss

of biodiversity and sustainable agriculture provides economic opportunities to restructure and make a more efficient energy and agricultural systems, and can provide additional benefits such as reducing local and regional air and water pollution, with positive implications for human health. The benefits of limiting climate change and sustainably managing ecosystems far exceed the costs of inaction, and delaying action can significantly increase costs.

Unless we act now to limit human-induced environmental degradation, history will judge us as having been complacent in the face of compelling scientific evidence that humans are changing the Earth's environment with predominantly adverse effects on human health, ecological systems and socio-economic sectors. Do we really want our heritage to be that of sacrificing the Earth's biodiversity for cheap fossil fuel energy, ignoring the needs of future generations, and failing to meet the challenge of providing energy and food in an environmentally and socially sustainable manner when so many choices were available? Leaders from government and industry must stand shoulder to shoulder to ensure that the future of the Earth is not needlessly sacrificed.

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The Tyndall Centre for Climate Change Research is a scientific research organisation based in the UK that brings together scientists, economists, engineers and social scientists who are working to develop sustainable responses to climate change.

The priorities for Defra are sustainable food production, a healthy natural environment and a green economy that is climate resilient. Defra works with other government departments, local government, the private sector and civil society.

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Ecosystem based adaptation

Figure 1: An IFAD-supported project has restored vegetation in about one third of the vast Badia rangelands in Syria.



Adapting agriculture to climate change:

a 'no-regrets' option for development and environment



Kanayo Nwanze, President of International Fund for Agricultural Development (IFAD)

Elwyn Grainger-Jones, Director of Environment and Climate at IFAD

Feeding a global population of just over 9 billion by 2050 will put huge pressure on our planet's scarce natural resources, even without climate change. The world's 500 million smallholder farms already provide the bulk of the food eaten in developing countries but will need to play an even greater role. Appropriate and innovative finance is needed for the poorest communities to build their resilience to climate change.

Climate change follows no monthly calendar. But with its hard-hitting storms, increasing droughts and severe floods damaging farmlands in developing countries, it is demonstrating its inexorable progression, and putting 500 million smallholder farms at increasing risk.

The international community, governments and private sector share an important responsibility to finance and support climate resilient agriculture.

We have many proven measures to support them but success will depend on how effectively we empower smallholders to manage their assets, of which the natural resource base is perhaps the most important, and diversify their farm and off-farm businesses. Public sector investment in sustainable agricultural practices and technologies must be coupled with improved access to markets, microfinance and a range of other services for rural communities. This will make it possible for smallholders to invest in their assets and knowledge, unleashing their potential to be agents of adaptation.

Smallholders bear the brunt of climate impacts

Rural communities are particularly vulnerable to climate change given their direct reliance on weather-dependant natural resources, their often limited access to institutions and markets, and their resulting reduced capacity to cope with a range of shocks such as food price spikes or extreme weather events. By damaging the asset base of smallholder and subsistence farmers, degrading their

soils, water sources, forest, sea and river products, climate change reduces their incomes and their chance to thrive. Adaptation for them is not optional but an increasing, daily challenge.

Today, smallholder farmer households represent half of the world's undernourished people, three-quarters of Africa's malnourished children, and the majority of people living in absolute poverty and in marginal ecosystems. Globally, smallholder families constitute the vast majority of the poor, living on less than US\$2 a day. Climate change has reduced the likelihood of achieving the first of the Millennium Development Goals (MDGs) to halve the prevalence of hunger by 2015, with Sub-Saharan Africa likely to be the most food insecure region. In ten years' time, between 75 and 250 million more people in Africa alone are expected to be exposed to water and food security stress – the majority of them rural and smallholder farmers.

Growth in agricultural productivity will need to almost double every year to avoid encroaching into already stressed ecosystems and make up for the impacts of climate change (*World Development Report 2010*). Smallholder farmers are too big a group covering too large a land area to be ignored, under the assumption that increasingly industrial agricultural production will render them non-players. Rather, we should recognise them as a cost-effective investment for increasing yields and intensifying agriculture in ways that reduce poverty, maintain and build on the natural resource base and enhance climate resilience.

Do more, better: an ecosystems approach

If the agricultural systems that smallholders manage are to be productive and sustainable, they need clean water and healthy soil, and a variety of genetic resources and ecological processes. A healthy ecosystem can foster productivity and diversify income-generating activities, for instance through apiculture, the harvesting of indigenous medicinal plants or ecotourism. The international

In the arid Syrian steppe zone or Badia, IFAD is working with local communities to reduce herders' vulnerability to climate change and restore the long-term productivity of rangelands after years of severe drought and intensive grazing. By reintroducing native plants that help meet fodder requirements, fixing the soil and stopping sand encroachment, ecosystems have been restored and the local population's vulnerability to the effects of climatic instability reduced. After two years of resting, reseeding and planting, birds, insects and animals returned to the area contributing to ecosystem restoration, see Figure 1.

community has come to clarity on the point that healthy ecosystems underpin sustainable development.

However, the *Fourth Assessment Report* of the Intergovernmental Panel on Climate Change (IPCC) in 2007 warned us that the resilience of many ecosystems to changes in climate could be surpassed within our lifetimes. This represents a huge threat for agriculture. For temperature increases exceeding 1.5 – 2.5°C, about 20-30 per cent of plant and animal species will be at increased risk of extinction and major changes in the ecosystem are predicted in the medium and long term.

Even in the near future, agriculture will take place under significantly changed environmental conditions. For developing countries, particularly Africa, it will require producing more under less favourable conditions. In all cases, it will require dealing with more uncertainties. In a few decades, the world could see more food insecurity and hunger crises, more conflicts over scarce natural resources, and more displacement and migration. If we don't adopt climate-resilient agriculture now, any gains we make will be compromised.

As the custodians of natural resources, smallholders' engagement in ecosystem-based adaptation is key in promoting sustainable agriculture programmes. The involvement of grassroots organisations, community groups, women and young people in planning and managing the natural resources that sustain agriculture is essential for an ecosystems approach.

Leaving the 'trade-off' mentality behind

Once we understand that making agriculture climate resilient is also about protecting and enhancing ecosystem services, we come to an important conclusion: the choice between reducing poverty, adapting to climate change, feeding the world or protecting the environment is a false one. What we need, in the words of Professor Swaminathan, is an 'evergreen' revolution powered by sustainable agriculture that balances inputs with crop needs so that surplus inputs are avoided and soil fertility and the ecosystem are not compromised, and 21st century technology that will simultaneously achieve all of these objectives and include smallholder farmers.

The challenge that we now face is to scale up the right sustainable practices in the right places, and to ensure that smallholder farmers can adopt them and benefit from them.

Start by scaling up the 'no-regrets' actions

There is a range of proven agricultural practices and technologies ready to be deployed at scale to limit the negative effects of climate change and provide substantive development gains. Balanced-input agriculture, for example, makes the most efficient use of seeds and fertiliser, land and water, energy and labour. Great strides are being made to bring cropland, rangeland and woodland under sustainable land management (SLM) approaches that are grounded in community empowerment, including land tenure rights, and efficient use of natural resources. Conservation agriculture techniques are also showing real promise for scalable methods of production and 'green' approaches in land use and preservation.

Agro-forestry and other integrated agricultural approaches provide improved vehicles for dealing with complexity and change.

Technologies ready for scale up include tolerant/resistant crop varieties based on drought or heat, salt, insects or pests, and improved seeds, all of which provide potential for increasing yields and improving the resilience of livelihoods across regions.

Agro-forestry and other integrated agricultural approaches provide improved vehicles for dealing with complexity and change – and we have seen them make a difference on the ground through better irrigation, fisheries management and infrastructure that achieve development and poverty reduction objectives and build climate resilience.

We are ready to do more of all of this, at scale.

Support new technologies for long-term challenges

In the face of long-term climate challenges, we know that today's knowledge and technologies won't be enough. IFAD therefore supports promising technologies that are new to the market but still require promotion and piloting. In development jargon, they are more 'knowledge-intensive' – which means that farmers need training in how and why to use them and incentives to adopt them, while governments need support in formulating policies that provide those incentives either directly or through markets.

Value traditional knowledge to strengthen resilience

New technology is important, but one weakness of the first Green Revolution was that it overlooked the value of traditional knowledge and the seed varieties held by farmers. Promoting, revitalising and scaling up existing local and traditional knowledge on crop management

Dutyion™ Test Site in the United Arab Emirates.



One example of a promising new technology is the Root Hydration System owned by DuPont. Faced with increasing climate-induced water stress, the government of Jordan, in collaboration with IFAD, the Global Environment Facility, DuPont and local farming communities, is testing this innovative and low-energy irrigation technology. The innovation is a new, durable plastic tubing material that retains contaminants while letting clean water through the pipe's surface to the plants' roots. This new system will allow farmers to use saltwater and low-grade, brackish water to irrigate their crops. It has great potential to increase the land available for cultivation, enabling smallholder farmers to grow more crops in water-stressed zones, particularly in coastal areas, without competing for precious freshwater supplies.

and ecosystem services can effectively support adaptation to climate change by marginal rural and indigenous communities and strengthen the deployment of new technologies.

IFAD is supporting indigenous communities through programmes such as the Regional Programme in Support of Indigenous Peoples of the Amazon Basin (PRAIA). The programme aims to recapture the traditional knowledge of indigenous groups that helps them diversify their incomes and food sources, for example, in the harvesting of indigenous plant species for food in times of drought and medicine in times of hardship.

Practical research to benefit smallholders

Climate adaptation requires the blending of local knowledge with scientific research. IFAD has a history of supporting and interacting with research institutes and other technical bodies, including the Consultive Group on International Agricultural Research (CGIAR), to test, adapt and disseminate technologies.

IFAD has taken a lead in mobilising interest in and donor support for research on some of the most important crops of poor people, such as plantain, bamboo and rattan, and cassava. Cassava research has been supported for over two decades, with a range of products generated, including improved cassava varieties, highly cost-effective biological control technology for two major cassava pests, transfer of improved cassava varieties from Latin

America to Africa and, together with CGIAR, the Food and Agriculture Organisation (FAO) and others, the development of a global cassava development strategy, with significant benefits for rural poor people.

Beyond carbon markets: payments for environmental services

Given the apparent difficulties in securing access for smallholders to carbon market revenues, we must look more closely at other payments for environmental services (PES) approaches to provide smallholder farmers with increased revenue streams or incentives and foster an integrated and sustainable approach to agriculture.

PES, if formulated correctly, has significant potential to bolster rural livelihoods and agricultural yields, and maintain and enhance ecosystem services, such as watersheds and biodiversity. In addition it can contribute to disaster risk reduction, with PES revenues generated serving as financial buffers for communities to climate-induced shocks. Provided with financing opportunities and incentives, smallholders and rural communities can invest in preventing natural disasters by maintaining sand dunes, mangrove belts, coral reefs, wetlands and forested slopes as cost-effective measures, while at the same time protecting their own assets and livelihoods. Dependable revenue streams would allow them to invest in their crops and land, strengthening their businesses.

Increase smallholder profits through sustainable value chains

There is often a misconception that sustainable approaches to agriculture are not profitable or that smallholders are not viable business partners at scale. The experience base that IFAD has built with partner

In the Philippines, the IFAD-supported Cordillera Highland Agricultural Resource Management Project has replicated the 'Lapat' indigenous system to protect the country's vast watersheds. This traditional system calls upon all community members and neighbouring communities to observe rules for environmental protection. These include restrictions on cutting trees, gathering rattan, hunting animals, and even fishing in the rivers and streams within the 'Lapat' area.

By promoting adoption of the 'Lapat' system, national and regional authorities have empowered indigenous communities to take over the responsibility, care and management of forests and natural resources. By the end of 2007, some 50,000 households were practicing the 'Lapat' system. The sustainability of this approach lies in the blending and linking of indigenous practices within modern institutional and policy frameworks. In this case, ancestral land was surveyed and over 1,000 land ownership certificates were issued, strengthening the indigenous communities' vested, long-term interest in their land.

A promising pilot called Reward Upland Poor of Asia for the Environment Services they Provide (RUPES), implemented in China, Indonesia, Laos, Nepal, the Philippines and Vietnam through the World Agroforestry Centre, has shown great potential for PES. In Indonesia alone, over 6,000 farmers in 18 communities received permits to grow coffee while protecting the forests. Providing communities with clear land tenure rights gave them the incentive to maintain or restore environmental services, such as replanting and managing forest areas. In addition to a scaled up RUPES-II project, a follow-up programme, Pro-poor Rewards for Environmental Services in Africa (PRESA) is currently being piloted in Guinea, Kenya, Tanzania and Uganda. These activities are providing further evidence that PES incentives don't necessarily need to be financial, but can be provided in the form of secure land rights.

governments and smallholder communities demonstrates the contrary. The private sector does have an appetite for working with smallholders when they are sufficiently organised. Public-private partnerships can help to identify where smallholders' comparative advantages lie and connect more of them to business opportunities, increasing their profits.

In Sao Tome and Principe, IFAD linked cocoa farmers with KAOKA, a French organic chocolate-maker that agreed to purchase as much organic cocoa as farmers could supply. The programme halted the planned razing of existing cocoa plantations, maintained their productive capacity, avoided a potential increase in pesticide use and considerably improved the incomes of participating farmers from 25 per cent below the poverty line to eight per cent above it. This is just one example of linking smallholder farmers to eco-efficient value chains.

In today's globalised world, international markets coexist with traditional markets characterised by smallholder-dominated, low-input production systems. Environmental or eco-friendly value chains can provide good opportunities for smallholders because of the value they place on certain low-input production methods. Value chains also offer an opportunity to promote and support sustainable agriculture practices.

IFAD is working with smallholders and other partners in Albania, Cameroon, Fiji, Guatemala, India, Laos, Morocco, Zambia and elsewhere to get their sustainably produced fish fingerlings (young fish), french beans, onions, coconuts, turmeric, olives, almonds and meat to larger markets. Farmers, fishermen, herders and governments all understand that profits lie in access to markets, and agricultural value chains can provide that access. Given the opportunity and incentive to link to them, farmers will organise and co-operate to compete. Support will help them strengthen their comparative advantage and remain competitive in an increasingly globalised and volatile international agricultural market.

Smallholders are ready

The imperative of reducing emissions globally to stave off climate change is clear but we must ensure that climate and other innovative finance reaches the poorest communities to build their resilience to climate change. The World Bank-led *Economics of Adaptation to Climate Change* study estimates it will cost US\$70 – 100 billion each year to adapt to climate change between now and 2050. Unfortunately, additional financial support for adaptation to date has been woefully inadequate.

Smallholder farmers account for 60 per cent of global agriculture and provide 80 per cent of food in developing countries (Cosgrove and Rijsberman 2000). Their households account for almost one-third of the world's population, and constitute the largest share of the developing world's undernourished (FAO). We must embark on a rapid programme of action to increase sustainable agriculture that rewards 'no regrets', multiple-benefit investments and includes smallholders. Many of these approaches are already available. It's time for the public sector to prioritise these and give the market signals the private sector is looking for.

Kanayo F. Nwanze began his term as IFAD's fifth President in April 2009, after serving for two years as Vice-President. Prior to that, he was Director-General of the Africa Rice Center for a decade, and was instrumental in the establishment of the Alliance of CGIAR Centers. He was asked to chair the World Economic Forum's Global Agenda Council on Food Security in 2010.

Elwyn Grainger-Jones joined IFAD in 2009 to set up and lead its new Environment and Climate Division. Previously, he established and led DFID's Climate and Environment Department and held positions with the World Bank, as its trade representative in Geneva, the EBRD, and the Overseas Development Institute as a fellow in Guyana.

IFAD is an international financial institution and specialised UN agency and has, since 1978, invested over US\$12 billion in grants and low-interest loans to enable rural poor people to grow and sell more food, increase their incomes and determine the direction of their own lives.

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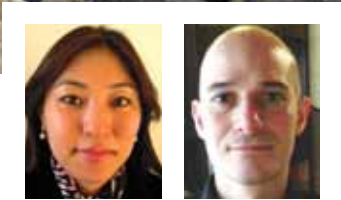
Some call it a geological fault



© Still Pictures

UNEP also calls it geothermal electricity
UNEP AND CLIMATE CHANGE: INVEST IN THE GREEN ECONOMY

Figure 1: Independent Samoa: coastal defences are vulnerable to damage.



Lilian Yamamoto, Researcher, Kanagawa University and
Miguel Esteban, Assistant Professor, Waseda University

Disappearing island states: ecosystem adaptation or relocation?

Climate change could have devastating effects on low-lying island states, which could disappear altogether in the course of this century with disastrous consequences for their inhabitants and their legal status. At present, the survival of these islands hinges on the ability of the local ecosystem of coral reefs to adapt to the consequences of a warmer planet. However, these vulnerable ecosystems are already under great stress. Coral reef conservation measures are required if these nations are to survive.

Small island states are extremely vulnerable to sea-level rise and climate change, and it is feared that some of them could disappear altogether in this century. Many of the islands that make up these countries are atolls with their highest points only a few metres above sea level. Even a small rise in sea level would profoundly affect the ecosystems of these vulnerable islands, severely diminishing their ability to provide food for their inhabitants.

There is little option to move to higher ground which means climate-induced migration could be the only option. Other consequences of climate change such as coral bleaching are also placing stress on the local environment. Coral reefs are vital to the existence of atolls, sustaining local fishing, supporting the tourist industry and acting as barriers against wave action and coastal erosion. Most important of all, they provide the sand that makes up the very islands themselves.

In order to address the vulnerability of small island states to climate change, adaptive measures are already being implemented. These measures require technological and institutional adjustments at all levels of society, though their success is by no means guaranteed.

Vulnerable atoll island states

The beautiful islands of Tuvalu, Kiribati, the Marshall Islands, Tokelau and the Maldives (See Figure 4), are some of the most famous atoll island states that are facing problems because of climate change. According to the Fourth Report of the Intergovernmental Panel on Climate Change (IPCC), there is “strong evidence that under most climate change scenarios, water resources in small islands are likely to be seriously compromised”, as they tend to be especially vulnerable to change.

“Coral reefs are vital to the existence of atolls, sustaining local fishing, supporting the tourist industry and acting as barriers against wave action and coastal erosion.”

Most of these islands are also comparatively underdeveloped and so lack the financial, technological and material resources to implement adaptation measures. Increases in tropical cyclone intensity as a consequence of warming surface sea temperatures could potentially also increase the damage caused by these events and further limit the islands’ already low adaptive capability. Communities are left particularly exposed as

Ecosystem based adaptation

Figure 2: Cross-section through a typical coral island.

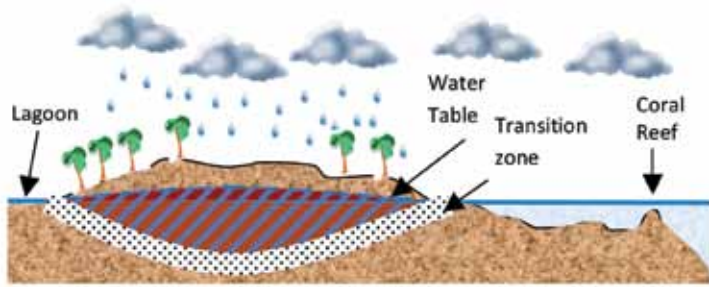


Figure 3: Houses in atoll islands are often located close to the sea (photo from Tuvalu).

most houses are built right on the coastal margins (See Figure 3).

Coral reefs form the key ecosystem on which atolls depend, normally surrounding the entire circumference of the island, as shown in Figure 2. They form one of the most productive ecosystems on Earth and they support a rich marine biodiversity which, in turn, provides various environmental services to nearby human populations, such as fishing, tourism, shoreline protection and medicines.

Loss of coral reefs

Although freshwater resources are fundamental to the long-term ability of the islands to support vegetation and crops, the main threat to the survival of the islands themselves is related to the wellbeing of their coral reefs. Currently, a great number of coral reefs are affected by the phenomenon of bleaching, the frequency of which has increased markedly in the past decades. While corals might recover from bleaching, many die off completely.

Coral bleaching results from a variety of stresses which can include high sea temperatures, high levels of ultraviolet light, low light conditions, high turbidity, pollution and abnormal salinity. Nevertheless, the majority of large-scale coral bleaching has been linked to the presence of increased sea surface temperatures. It is currently believed that coral growth around the atoll islands will not be able to overcome the stressors to which they are currently subjected and that places like Kiribati, Tuvalu, the Marshall Islands and the Maldives could become submerged within this century.

Funding needed for research and adaptation

Adaptive measures have been discussed through the National Communications to the UN Framework Convention on Climate Change (UNFCCC) from small island states, who have assessed their own vulnerability to climate change. The most common theme stated was the immediate need for sufficient financial resources to fund urgent action. Freshwater was seen as a serious issue and many island states recognised the need for more integrated planning and management concerning coastal zones, human health and tourism, as highlighted in the Fourth Report of the IPCC.

There is a growing realisation that the future supply of freshwater might be threatened due to increasingly variable rainfall, more intense drought events and increased salinity of the soils on coastal margins. Often, the freshwater table in these islands is already contaminated due to the increased frequency of 'king' tides, which results in sand being deposited over agricultural lands and a general increase in the salinity of the islands.

In order to protect the shorelines of these islands, technical and policy measures have been used. Some relate to the preservation of coral reefs, mangrove areas and sandy beaches, with numerous studies recognising that the preservation of these coastal barrier systems is essential to the survival of atolls. However, at present not enough is known about how coral reefs could adapt to the multiple stressors that are being placed on them.

Coral replanting has been shown to be successful in many areas around the world.

It is imperative not only that more research is carried out on how these ecosystems may behave in the future, but also to ascertain which species of corals will prove more resilient to climate change, in order that they could be replanted in areas where they have disappeared. Coral replanting has been shown to be successful in many areas around the world, though the long-term success of these schemes would depend on the general ability of the planted species to cope with the changes in their environment. This is poorly understood at present, and should become an area of priority research in the future.

Coastal protection: nature knows best

Vulnerability has two factors: the susceptibility of communities or natural systems to environmental changes, and their resilience. It is possible to increase the resilience of coastal communities through infrastructure and hence another possible adaptive measure is the construction of sea dykes and defences. However, this solution would be costly: the Japanese government constructed several concrete barriers to protect the tiny

Figure 4: Many atoll islands are important tourist destinations and places of great natural beauty (Maldives).



Japanese island of Okinotorishima at a cost of 29.3 billion yen (approximately US\$360 million).

For small island states, the problem is securing the financial resources necessary to implement such costly schemes. As the IPCC identifies; “the costs of overall infrastructure and settlement protection are a significant proportion of GDP and well beyond the financial means of most small island states”. Even in the hypothetical situation where enough financial resources were available, defence work could create a situation where islands end up being lower than the surrounding sea, similar to the low-lying polders surrounded by dykes in the Netherlands.

However, the hypothetical ‘polder-like’ atoll island would end up, even in a best-case scenario, a barren piece of land due to the high salinity of the water beneath it. More likely, water would seep under the defence works due to the pressure differential and inundate the area behind it, requiring expensive ground improvement works and constant pumping. Coastal defences are also vulnerable to damage. Figure 1 illustrates the case of Samoa, a string of tiny islands in the Pacific Ocean. Although not atolls, the islands also suffer from the problem of coastal erosion. Generally this is a problem that affects all tropical islands, and the economic benefits of having a resilient, ‘living’ coast are clear. An artificial barrier will require constant reconstruction and maintenance, whereas a healthy coral reef will rebuild itself and greatly reduce the maintenance effort required by coastal communities. Ecosystem adaptation measures are therefore likely to be superior to human engineering solutions, particularly in cost, and should be prioritised.

Ecosystem destruction and community relocation

Ultimately, if the adaptation measures described above fail, it will be necessary to relocate island communities. However, if all the islands that presently form one of these archipelagic atoll countries are completely submerged, their citizens would lose their nationality as, under conventional international law, a state is required to possess a defined territory. In addition, refugee law would not apply to these people since they do not fulfil the conditions to become refugees. The Refugee Convention defines refugees as people who are outside their country of origin with a well-founded fear of persecution on account of their race, religion, nationality, political opinion or membership of

a particular social group. Nevertheless, certain protective measures could be applied, such as the principle that no one should be sent back to their home countries to suffer persecution.

Thinking about all of these consequences can be considered alarmist. However, it is clear that there is the potential for them to happen and that there is a moral imperative for those who are most responsible for the causes of climate change to address the consequences. In this case, ensuring the survival of local ecosystems is probably the best way to prevent the disappearance of these islands and their populations. However, this will no doubt require much research, ingenuity and local action to preserve and help the coral reefs adapt to the new environmental conditions forced upon them. The alternative would be not only for whole cultures to be lost, but also for countries to have to start dealing with influxes of climate-change induced migrants from all over the planet.

The photographs used in this report were originally taken by Sergio Fernandez, Gloria Caramanzana, Tomoya Shibayama and Hiroshi Takagi. Their permission to use them is kindly acknowledged.

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UNU-IAS is among the newest in a network of research and training centres within the UNU system. The Institute is dedicated to identifying, developing and implementing solutions for a more sustainable world.

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Coral reefs are among the ecosystems most threatened by climate change.



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Julia Marton-Lefèvre
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Building resilience to climate change: a natural solution

Healthy ecosystems can play a major role in helping people to adapt to the adverse impacts of climate change. Ecosystem-based adaptation recognises the wide-ranging environmental services nature provides for free and aims to strengthen them in order to build long-term, cost-effective resilience to a warming climate. Ecosystem-based adaptation thinking is being employed around the world to reduce climate change impacts.

We increasingly hear about the negative impacts of climate change, that some parts of our planet will be drier, some wetter, most warmer, and many affected by increasing uncertainty and variation in weather patterns and seasonal change. What is certain is that we need to adapt to the changes which are already underway, and to which we are committed in the coming decades. The fact that we cannot predict the exact impacts of climate

change makes us look for ‘no-regrets’ options – those that will bring cost-effective benefits under most climate change scenarios. Ecosystem-based adaptation emerges as one such response, providing natural solutions to support both people and nature to cope with the adverse impacts of climate change.

Ecosystem-based adaptation may sound like an intricate invention, but in essence it means managing our natural environment to build resilience in local communities to climatic and other changes. It is not an entirely new concept either. Throughout human history, societies have adapted to changes in climate conditions by alternating settlements, agricultural patterns and other sectors of their economies and lifestyles. Many of these adaptive solutions have relied on management of our surrounding environment, giving people a chance to ‘adapt’, and nature to ‘adjust’ to cope with the changes that occur in climate patterns.

Today, studies in different parts of the world – from the wetlands in the African Sahel to the coral reefs in the Caribbean and the Andean highlands – have clearly demonstrated that climate change affects farming and fisheries, water flow regimes and carbon sequestration processes, as well as human and wildlife migration, to name but a few.

Healthy ecosystems provide drinking water, habitat, shelter, food, raw and genetic materials, and natural barriers against disasters – often at low or no cost. An estimated two billion people who live on less than US\$2 per day directly depend on these natural resources for their wellbeing. These ecosystems are now facing greater pressure because of climate change. However, if well-managed, they can also offer a solution to people who depend on them.

Coping with a fresh water crunch

Water is at the centre of many climate change impacts. The latest figures tell us that about 80 per cent of the world's population lives in areas where the fresh water supply is not secure, and climate change will bring more thirst. In many places around the world, water demand is already outstripping supply.

There is little doubt that the climate in the Pangani River basin, shared by Kenya and Tanzania, is changing fast. Along the length of its 500km course, people talk of better times, lodged in living memory, when there was more water. The Pangani was higher and stronger, and flow was guaranteed through the two dry seasons of every year.

However, the ice cap of Mount Kilimanjaro, which provides much of the water for Pangani, has melted considerably and may disappear altogether before the end of the century. As a result, flows in the basin have been drastically reduced, and conflict over the dwindling resource now requires wise management.

Through the Pangani River Basin Management Project, IUCN and partners are working on preparing the different water users – farmers, hydropower, fishermen,

residents – for future reductions in water availability while also ensuring that enough water is left to sustain natural infrastructure such as wetlands and estuary habitats.

One in three of the world's 100 largest cities draw some of their drinking water from forest protected areas. For example, the Te Papanui Conservation Park in New Zealand's Lammermoor Range provides the Otago region with water for free that would cost NZ\$136 million to bring in from elsewhere.

This is also the case of Colombia's capital Bogotá, which relies heavily on water provided by the extremely fragile highland páramo ecosystems in the Andes – up to half of which may disappear by 2050 if climate change continues unchecked.

The city recognises its dependence on ecosystems and the environmental value generated by protected areas. To cope with these threats, Colombia is implementing an Integrated National Adaptation Plan, which promotes land-use types that might respond successfully to climate change.

For example, agro-ecosystems have good water regulation and carbon storage potential. That's why the project works with some 100 farms to encourage organic farming, native tree planting, and soil and water conservation practices. In fact, how the land is used and will be used emerges as both the biggest cultural change and the key adaptation measure in the long run.

Farming in times of climate change

Agriculture is the mainstay of livelihoods in some of the world's poorest countries. Farming in a drought-prone region such as the African Sahel has always been risky business but, with the onset of climate change, producing enough crops to survive until the next harvest is an ever-greater challenge.

This is how an old farmer from Niger, a country often making the headlines because of persistent droughts and chronic famines, describes the observed changes: "We used to wait with sowing our millet until we found the soil had been wetted to the depth of our elbow when we dug a hole by hand. Now, we sow when the soil has been wetted only to the depth of our wrist. The way the rains are now, we cannot afford to wait any longer than that. We feel that drought periods during the rainy season are also more common than they used to be."

Farmer ingenuity notwithstanding, rains can be so poor that the millet harvest is insufficient for a farming family to make it to the next harvest, 12 months later. And if all else fails, rural communities turn to wetlands for subsistence, with activities ranging from fishing to livestock grazing. It is estimated that the value of Niger's 1,000-plus wetlands for livestock production alone is around US\$35 million per year.

During the dry season, wetlands are faced with growing demands, not only from people, but also wildlife – an estimated 1.8 million waterfowl come from Europe and Asia to spend the winter in Niger. And with the country's population projected to triple by mid-century, the pressures on natural resources will grow even without the likely climate change impacts, such as decreases in rainfall and soil productivity.

Conserving ecosystems can help build resilience in communities.



© IUCN/Danielle Perrot-Maitre

Ecosystem based adaptation

The case of Niger is no different from other parts of the Sahel; wetlands and other ecosystems are critical resources in times of climate change. To prepare our farmlands for the future's climate, we first need to preserve our wetlands.

Protecting the coast

Coral reefs are among the ecosystems most threatened by climate change. Already, 70 per cent of coral reefs are threatened or destroyed in the seas and oceans around the world. However, well managed and more resilient coral reefs can also be a major contributor to adaptation and human well-being in the face of climate change. Coral reefs provide food, storm protection, jobs, recreation and other income sources for more than 500 million people worldwide with an average annual value estimated at US\$172 billion.

In many island communities, such as San Andres in Colombia's Caribbean, the local economy relies almost entirely on coastal tourism and mangrove and reef-based fisheries. The 65,000km² Seaflower Marine Protected Area (MPA) around the San Andres islands is Colombia's first and largest such area and protects the Caribbean's most extensive open-ocean coral reefs. However, climate change now threatens the ecosystems the MPA was designed to protect, in turn threatening the very survival of the community that both manages and depends on it.

“The way we treat our natural assets today will determine how well we will withstand the changing climate of tomorrow.”

In response to these challenges, the community put into practice ecosystem-based adaptation as the most viable and cost-effective option. The approach relies on recovering and maintaining 'natural infrastructure' such as coral reefs and mangroves – which provide increasingly important protection from storms and flooding – rather than on engineering and costly human-made infrastructure like sea walls, jetties and levees, which many developing nations simply cannot afford.

For instance, the government of the nearby Caribbean island nation of Jamaica estimated that protecting the coastline from a sea-level rise of one metre would cost up to US\$426 million, or nearly one-fifth of its GDP. Meanwhile, a recent study in the Maldives found that coral reefs provide coastal protection services worth between US\$1.6 – 2.7 billion if they were to be replaced by seawalls, breakwater and other human-made structures.

At a fraction of the cost, ecosystem-based adaptation will provide benefits beyond protecting the coast, by sustaining productive fisheries, maintaining beaches and the translucent coastal waters that draw tourists, and reducing pollution all at the same time. Proper

management of the Seaflower MPA will keep coastal and marine ecosystems healthy and biodiversity high, while allowing the community to better control and cope with impacts of the changing climate.

A natural response to climate change

Many adaptation initiatives have focused on costly human-made infrastructure and technologies to build climate resilience, ignoring natural responses to climate change, which are often cheaper and more sustainable than 'quick-fix' technological solutions.

Conserving ecosystems can moderate the impacts of climate change and help build resilience in both ecosystems and communities to the impacts of climate change. Conversely, as biodiversity and habitats decline, so does the resilience of entire ecosystems and thus many of the services they provide to humanity.

The way we treat our natural assets today will determine how well we will withstand the changing climate of tomorrow. Ecosystem-based adaptation helps us move from short-term coping tactics to deal with current climate variability to develop long-term strategies necessary to address future climate change.

Julia Marton-Lefèvre is Director-General of IUCN. Prior to this position, she was Rector of the University for Peace, Executive Director of LEAD International and Executive Director of The International Council for Science. She is a member of several boards in the fields of environment, development, science and international co-operation. In 2008, she was made 'Chevalier de l'Ordre national de la Légion d'Honneur' by the French government and named Global Ambassador for Hungarian culture. She is a Fellow of the Royal Geographical Society in the UK and of the World Academy of Art and Science.

IUCN is the world's oldest and largest global environmental organisation with more than 1,000 government and NGO members and almost 11,000 volunteer experts in some 160 countries. IUCN helps the world find pragmatic solutions to our most pressing environmental and development challenges. It works on biodiversity, climate change, energy, human livelihoods and greening the world economy by supporting scientific research, managing field projects all over the world and by bringing governments, NGOs, the UN and companies together to develop policy, laws and best practice.

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Sustainable fishery

Spreading the environmental message

The Heiploeg Group is Europe's largest shrimp processor. Their mission is to 'grow the market for shrimp by excelling at customer satisfaction, innovation and sustainability'. In the drive towards securing sustainable seafood, the group has actively supported and invested in the shrimp standard of Global Gap and the Marine Stewardship Council (MSC) route for brown shrimp and the Atlantic seabob shrimp.

Heiploeg has extensive Atlantic seabob shrimp fishing and processing operations in Suriname and Guyana. With two shrimp fishing fleets at sea in South America, Heiploeg is determined to see the introduction of sustainable fishing practices in the region. The company has therefore worked alongside scientists, the WWF, the governments of Suriname and Guyana and other shrimp fishermen, in order to implement MSC protocols. The Suriname Atlantic seabob is currently under MSC assessment thanks to these endeavours.

Sustainable fishing practices: an important step forward

These developments in sustainable fishing demonstrate that governments in developing countries, even when hampered by limited resources, understand the need for ecological measures in order to preserve and develop key areas of the economy. Shrimp fishing is the fourth largest source of exports in both Suriname and Guyana. However, enforcing measures to keep the stock in good condition may involve reduction in catching effort and total catch. This results in lower income levels for fishermen and processors in the short term.

Consumers and retailers in the key markets need to be educated about the importance – and the consequent costs incurred – of genuinely sustainable shrimp fishing. Heiploeg has chosen a strategy of vigorously marketing the Atlantic seabob as a sustainable shrimp. The company can therefore recuperate some of the investments and higher costs of fishing by adopting premium pricing strategy in the market.

Fortunately, the seabob is a delicious shrimp: chefs love to use it in salads or cooked dishes, appreciating its bite and flavour. In America, the seabob is at the heart of the much-loved, breaded 'popcorn shrimp'. It means Heiploeg is able to appeal not only to the social consciences of

customers but also their taste buds, highlighting the superior flavour and 'the taste of the ocean' you can get from a seabob shrimp.

In this way, Heiploeg has recognised that the 'green agenda' and corporate social responsibility is the most effective form of marketing in these times. And the company intends to go further than sustainable shrimp fishing: improved terms allow Heiploeg to enhance working conditions, health and safety, fisherman and worker pay, management development for their fleets and plants in Guyana and Suriname. These investments will be strong evidence for retailers, analysts, investors and consumers that Heiploeg is striving to be an ethical corporate citizen, not only in Europe but also in South America and elsewhere in the world.



For the fishermen of Guyana and Suriname, this year's COP will be in close proximity. There is much to feel positive about. Concrete and measurable improvements are being made by these countries to sustain the marine resources upon which they are dependent. Their fishermen work according to a code of conduct which means attaching Turtle

Escape and By-catch reduction devices to their nets. They are trained in the protocols for endangered and vulnerable species, as well as improved waste management.

Government and WWF observations in Suriname last year indicated that no turtles were accidentally caught during seabob fishing. The By-catch reduction devices have resulted in 34 per cent less by-catch being caught by the Seabob fleet. Clear fishing limits have been agreed by the government with all the fleet owners and processors and tracking technology has been fitted into all the boats at sea in order to ensure that the fleets fish only in the agreed areas.

It is Heiploeg's firm intention to pass on this conservation ethos to the next generation by spreading the environmental message of sustainable fishing.

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Guitarfish, rays and other fish are tossed from a shrimp boat, La Paz, Mexico.



James P Leape
Director General of World Wildlife Fund (WWF) International

World fish stocks: how can we bring them back to abundance?

Two-thirds of the world's fish stocks are at, or over, their limits of sustainability; yet one in four people depend on fish for their daily protein. How can the international community collaborate to ensure the recovery of major fisheries worldwide?

When an enigmatic Italian explorer first reported some 500 years ago that the waters of the Grand Banks off Newfoundland were so full of cod he could hardly move his ship, he might not have believed what was to follow.

For centuries, these once prolific waters withstood continued fishing effort. Catches remained steady, providing livelihoods for fishermen all along the coast and also generating huge amounts of wealth for Europe, whose vessels made the long trip to harvest the seemingly limitless bounty. But then, in the 1950s, a lethal cocktail of technology, knowledge gaps, and the economic imperatives of a society based on fishing, pushed cod stocks over the edge.

Catch sizes peaked in the late 1960s, but by then the death knell had sounded – though nobody seemed to hear it. When the Canadian government declared a moratorium on the cod fishery in 1992, Canada's east coast lost 40,000 jobs in hundreds of coastal communities. Prevention would have been better than cure.

Many fisheries around the world are in danger of suffering a similar fate. And while the international community can and must collaborate to ensure their recovery, we must be in no doubt about the scale of the issue.

Between 1976 and 2006, the total world trade of fish and fishery products increased more than 900 per cent to reach a record value of US\$86.4 billion (export value). In roughly the same period, the annual global catch stayed level while the amount of fish in the sea declined. Put simply, we are catching too many fish and, as we have seen in the Grand Banks, such pressure cannot be sustained.

An influential World Bank report, *The Sunken Billions*, points out that we are already suffering the consequences of overfishing – to the tune of about US\$50 billion per year. Firstly, depleted stocks mean there are fewer fish to catch, making the cost of fishing higher than it could otherwise be. Secondly, the massive overcapacity of fishing fleets around the world mean there are too many fishermen chasing too few fish.

Collaborative management

So how can we, the international community collaborate to ensure the recovery of our vital fisheries?

Clearly, we can be sharing information and technology. But the critical issue is actually ocean governance.

Today, fishing fleets around the world operate on the high seas (those areas outside of national jurisdiction) with a ‘free-for-all’ attitude, in which they have few incentives to move towards sustainability. Fishermen can have a tendency to think, “If my fishing boat does not get the fish now, we may not be able to catch them later on,” and, “If we invest in conservation now, somebody else, not us, might benefit from our investment by catching the fish we conserved.”

This “tragedy of the commons” was as true for the northern cod as it is for international waters around the world. High seas fisheries are a common resource, so means it is our fish that are being mismanaged and depleted, and it is the right of us all to see they are harvested sustainably. Collaboration is key to solving this problem. At WWF, we are pushing member governments and fishers involved in fisheries to ensure that the network of Regional Fisheries

“We are pushing for the UN General Assembly to adopt a resolution that will require all areas of the oceans to be subject to effective fisheries management.”

Management Organisations (RFMOs) is expanded both geographically and with respect to competency. In this way, we hope to ensure that all fisheries are subject to effective management and that rules are effectively enforced. Of particular concern to WWF is the regularity with which governments, under pressure from competing national fleets, agree to catch levels far above scientific advice.

It is not just about the “tragedy of the commons”, though. Foreign vessels fish in Exclusive Economic Zones (EEZs) within the national jurisdiction of coastal African countries, for example, thanks to access rights

granted to them by the host country in return for a fee paid by a foreign state. These fisheries are now feeding the populations of Europe – unable to supply demand from its own depleted fisheries – and, in so doing, are not only taking away precious stock from the local fishing communities but also undermining the development opportunities and aspirations of some of the world’s poorest countries.

Needless to say, monitoring of these management regimes will also require extensive collaboration and exchange of intelligence, especially in extensive regions like the Indian Ocean where many countries such as Mauritius and the Seychelles depend heavily on tuna.

“We are pushing for the UN General Assembly to adopt a resolution that will require all areas of the oceans to be subject to effective fisheries management.”

Second, the international community needs to pull together to reduce the devastating impact of non-target catch (typically termed ‘bycatch’) and the subsequent discarding of these creatures, often dead or dying, back to sea. Technology such as selective nets can play an enormous role in reducing bycatch. Fishermen in Scotland, for example, are now using cod avoidance gear, while Mozambique is slowly making good on its obligation to use turtle excluder devices in its shrimp fisheries. However, we also need to look at the structure of quotas and subsidies which encourage an enormous amount of waste. Quotas on individual species, for example, mean that fishermen catch a pile of fish but must then discard those whose quota is exceeded.

Third, we must work together to increase the amount of protected areas in the oceans. We know that effectively enforced no-fishing zones can do wonders for recovering fish stocks. For example, Australia’s Northern Prawn Trawl fishery benefited from the establishment of no-fishing zones and a reduction in the size of the fleet, among other measures.

Fourth, related to this, we need to tackle illegal, unreported and unregulated (IUU) fishing, which occurs in virtually all fisheries and may account for up to 30 per cent of total catches in some important fisheries.

Technology such as selective nets can play an enormous role in reducing bycatch.



Ecosystem based adaptation

IUU fishing includes breaking the laws and regulations of a country or an international agreement, misreporting catches to the relevant authority, or fishing in a way that undermines management efforts to conserve marine species and ecosystems.

Fifth, related to this, we must target the buyers, working on transparency and traceability. The fish fingers may look innocent enough. But the global supply chain for fish products often involves several countries, and without information-sharing on the provenance of fish, buyers may unwittingly be funding unsustainable fishing.

Gaining popularity in recent years among consumers and retailers alike, the Marine Stewardship Council (MSC) provides a stamp of environmental quality, certifying that fish has been caught in an environmental and sustainable fashion. If we encourage consumers and retailers to purchase sustainable fish, as indicated by reputable labels such as the MSC, then enormous progress can be made.

All around the world our efforts to collaborate and build trust with all parties are paying dividends.))

And sixth, the examples of Australia and Scotland where local fishermen have been closely involved with conservation initiatives, show how multi-stakeholder dialogue (and advocacy) – especially between fishermen, scientists, governments and NGOs – can help restore our fish stocks.

Building trust between stakeholders

Collaboration is central to WWF's work across the world. For example, in Canada we are engaged with local and national interests to help restore the Grand Banks; in India and African countries we are helping to reduce turtle bycatch by working with the local fishermen; and in South Africa, New Zealand and Australia we have extensive fisheries improvement projects. All around the world, in fact, our efforts to collaborate and build trust with all parties are paying dividends. In Scotland, as a case in point, WWF has been closely involved in the pioneering Scottish Conservation Credits Scheme since its inception. This initiative has built up trust between all stakeholders and preliminary results show it is clearly achieving its objective of cod conservation. But we are not complacent.

No excuses

We know exactly why Canada's cod stocks collapsed and we don't have any excuses for losing the blue fin and other commercially valuable species.

The absurdity of the present situation is that irresponsible decision making in the interests of short term profits is preventing the true economic and social value of fish from being fully realized.

We know what the problems are. We know the solutions too.

Some unscrupulous fishermen, call them pirates if you will, are being rewarded for stealing fish from the waters of developing nations and even from future generations.))

Governments have to listen to science when they develop new regulations and management strategies. Retailers, and consumers must also must take responsibility and reward those fishermen who do it right. To achieve long-term and sustainable results we have to see collaboration on one goal: the recovery of our fish.

James P Leape has been Director General of WWF International since 2005. A graduate of Harvard College and Harvard Law School, Jim began his career as an environmental lawyer – bringing environmental protection cases in the US, advising UNEP in Nairobi, Kenya, and co-authoring the leading American text on environmental law. Jim first joined WWF in the US in 1989, and for ten years led their conservation programmes around the world, serving as Executive Vice President. In that role, he helped shape the global strategy of the WWF Network and represented WWF in many international forums. From 2001 to 2005, he directed the conservation and science initiatives of the David and Lucile Packard Foundation, one of the largest philanthropies in the US.

WWF International's mission is to stop the degradation of the planet's natural environment, and build a future in which humans live in harmony with nature. To achieve this, it is working with its many partners to save biodiversity, and reduce humanity's impact on natural habitats. WWF's strategic focus is on conserving critical places and critical species that are particularly important for their habitat or for people. It is also working to reduce humanity's ecological footprint – the amount of land and natural resources needed to supply food, water, fibre and timber, and to absorb carbon dioxide emissions.

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ISA AND CLIMATE CHANGE

COP 16 ■ MEXICO 2010

At ISA¹, we are aware of the relevance the Latin American energy sector has for the global strategy seeking to prevent and mitigate the effects of climate change.

Latin America's electric generation matrix is one of the world's cleanest, a significant feat considering that production and use of energy account for 76% of the planet's total emissions. Our region has promissory natural resources, especially water; its installed hydraulic capacity nears 145 GW or 20% of the world's total and it has 594 GW of hydroelectric energy potential, of which only 25% has been developed.

ISA, aware of its importance for regional development, promotes the expansion of the energy transport infrastructure in Latin America. In this sense, the Company promotes integration and growth of international electricity transactions that bring important environmental benefits in terms of reduction of greenhouse gases.

This notion is in line with the Regional Electric Integration Commission's study known as CIER 15, which designated 12 projects in the Southern Common Market (MERCOSUR), the Andean Community of Nations and Central America that will prevent 7.8 million tons of CO₂ per year² in benefit of the environment.

Such actual and potential benefits for the Latin American energy sector are real and tangible. However, for them to materialize in the short term, they must be recognized and promoted by developed countries. For such reason, at ISA, we hope the next COP 16 defines a new cooperation strategy that provides for, among others, the following issues:

- 1 Having the technological cooperation and financial support of developed countries to strengthen infrastructure that under reliability conditions permits bringing clean energy along wide distances, offering it to other regions, and substituting it for more polluting sources.
- 2 Continuing with and improving the flexible mechanisms foreseen in the Kyoto Protocol, especially the Clean Development Mechanism –MDL, for its Spanish initials– given that as of today, no power interconnection project has received such approval. This is an urgent measure considering the big contribution of interconnections to the decline in greenhouse gasses.
- 3 Making viable regulatory adjustments that minimize the countries' disparities between energy regulation and environmental regulation, and facilitating advancement of international interconnections.
- 4 Promoting forest preservation and sustainable forest management by the energy sector as strategic action that guarantees conservation and sustainability of water resources. Such measures, which compensate the intervention caused by forest felling for rights of way, must be supported effectively by mechanisms for Reduction of Emissions from Deforestation and Forest Degradation –REDD, for its Spanish initials–.



Knowing that because of its low resilience capacity our hemisphere is probably the most vulnerable to climate change, we should work together to contribute to adaptation to the economic, social and environmental impact in Latin American countries. In the mid-term such vulnerability will become additional cause of poverty as well as one of the risks we will have to face to ensure our business' continuity and sustainability.

LUIS FERNANDO ALARCON M.
CEO, ISA

¹ Directly and through its affiliates and subsidiaries, ISA executes important projects in linear infrastructure systems that enhance continental development. For such purpose, its activities are focused on the businesses of Transport of Electric Energy, Market Operation and Administration, Telecommunications Transport, Construction of Infrastructure Projects and Road Concessions.

² El Sector Eléctrico de la Región CIER y el Cambio Climático Documento de Posición. REGIONAL ENERGY INTEGRATION COMMISSION CIER 2010.

Regional Focus

Hydropower, geothermal and wind energy have energy-generating potential in Costa Rica.



Teófilo de la Torre Arguello
Minister of Environment, Energy and Telecommunications for Costa Rica

Towards a new energy model for Costa Rica

Costa Rica is dependent on imported fossil fuels for much of its energy supply and consumption is rising. Costa Rica's dependency on imported oil leaves it vulnerable to the volatile prices of the international oil market. Although electricity is largely generated from renewable sources, there is great potential for increasing renewable energy capacity. Government plans to develop renewable energy, promote electric vehicles and improve energy efficiency will help Costa Rica become more self-sufficient and competitive while fostering genuinely sustainable development.

At the current pace of discovery and production of oil, it is estimated that reserves will be exhausted in 46 years, causing a supply crisis and high prices that will have a serious repercussions for importing countries such as Costa Rica.

Costa Rica's energy consumption

Costa Rica is a country rich in natural resources that could be exploited for energy purposes yet its development is based on the use of imported oil. Commercial energy consumption in Costa Rica is nearly triple that of 1989 levels and is predicted to increase further, as shown in Figure 1. Over 60 per cent of commercial energy consumption comes from oil and oil derivatives. Electricity consumption has increased markedly due to a rapid increase in electrification in both residential and industrial sectors.

Oil consumption over the last 20 years has increased by an average of 4.7 per cent year on year and electricity by 5.3 per cent. At current growth rates, demand for electricity will double in the next 13 years and hydrocarbons in 15 years.

Costa Rica's heavy dependence on fossil fuels, a result of past promotional policies when international oil prices were low, now leaves it vulnerable to price shocks and insecurity of supply. The transport sector is responsible

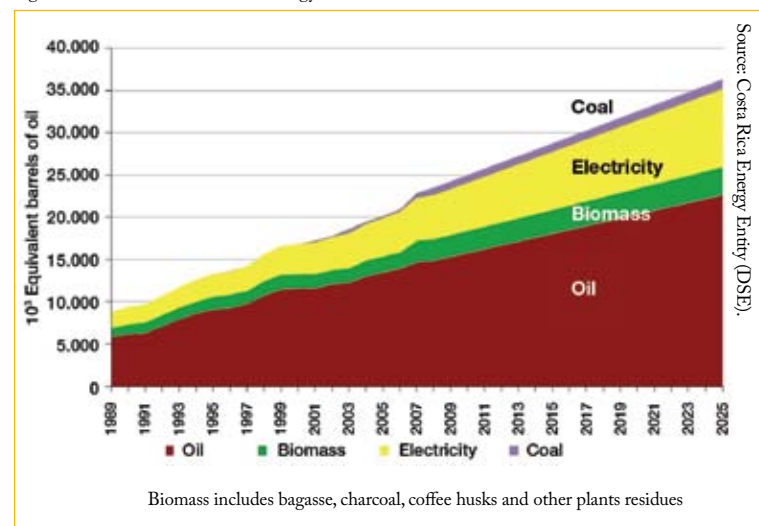
for over half of national energy consumption (51.2 per cent), followed by the industrial sector (25.9 per cent) and residential (10.5 per cent).

Costa Rica's potential for renewables

According to figures from the Costa Rican Electricity Institute, the country harnesses roughly a third of the total estimated wind power available. Meanwhile, the country's installed capacity for hydroelectricity and biomass are each less than a quarter of what could be achieved. Only geothermal energy is close to reaching its full potential with 63 per cent of what could realistically be used for energy production being utilised.

Hydropower, geothermal and wind energy have energy-generating potential in Costa Rica and projects to harness these resources have proved successful. Biomass, crop residues and biogas, is another key area for development.

Figure 1. Evolution of commercial energy in Costa Rica



A further priority is to improve energy efficiency. Studies show that improved efficiency measures and new technology could offer energy savings of between 10 and 20 per cent. Although energy intensity (energy consumption per unit of GDP) is decreasing, there still much to be done to improve efficiency, in production, storage and end use.

Electricity – domestically generated from renewable sources

The electricity production of the country is provided by water, geothermal and wind sources. These sources enable Costa Rica to enjoy some of the lowest electricity rates in Central America while bringing the twin benefits of greater energy independence and a reduced environmental impact. Figure 2 shows the sources used for electricity production in 2009.

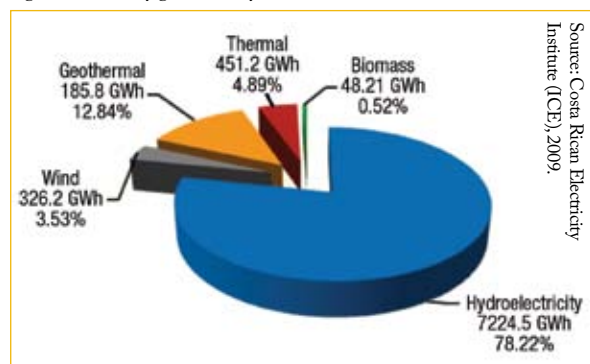
The work of the Costa Rican Electricity Institute (ICE) and other companies in the electricity subsector make a positive contribution to the nation's generation, transmission and distribution of electricity. Project implementation has long been conducted under sustainable development criteria, including both social and environmental elements.

There are many challenges facing the electricity sector. The national electricity industry must prepare for the greater competition generated from the creation of the wholesale Regional Electricity Market, (MER in Spanish). The MER was created through the Treaty Framework of Central American Electricity Market (Act 7848) and ratified by legislature in 1998. This entry into a very large energy market gives Costa Rica greater security of supply and an important opportunity to sell its renewable energy surpluses.

The vision – electric vehicles and a decarbonised future

We are in a transition phase from the era of cheap oil to another that is not yet well-defined. In the transition period, greater volatility in oil prices is predicted. Costa Rica had a taste of this in 2008 when it was forced to spend 22 per cent of its export earnings on paying its oil bill. An effective decarbonising strategy needs to be implemented rapidly to avert paying extortionate prices for energy.

Figure 2. Electricity generation by source, 2009.



Costa Rica has several initiatives to stem fuel demand including: education and information on energy saving measures; changes to work patterns; developing a more efficient highway network to ease road congestion; introducing electric and hybrid vehicles; improved technologies for heat production in the industrial sector; use of natural gas in public transport and industry; replacement of bunker oil by natural gas; progressive use of biofuels that do not compete with food production and phasing out the use of fossil fuels for electricity production.

Targeting the transport sector first, the biggest fossil fuel user, is paramount. The combination of the actions above should allow oil consumption to decline steadily, helped by a parallel emergence of new energy sources such as hydrogen and renewables. Figure 3 shows the possible stages of this transformation.

In the case of electricity, the first step is to stop using oil for its generation. This can be achieved gradually by increasing reserve margins of installed capacity of power generation on demand, which may occur by 2020. Building large hydroelectric projects is also essential.

With the support of all sectors of the economy and population, geothermal and wind capacity should increase. In the case of biomass, there must be a diversification of the use of all types of agricultural products to maximise its contribution to the energy matrix. It is clear that with the current growth rate of energy consumption, renewable sources will cover the electricity requirements only until 2033. After that, the system will need to incorporate new technologies or implement further efficiency measures.

It is necessary to establish a multidisciplinary organisation in Costa Rica capable of conducting ongoing analyses of the nation's future energy generation in the context of continual technological changes in the sector, and boosting innovation for a competitive advantage in the coming decades. State institutions and the private sector must join together to create a single management group capable of transforming Costa Rica into a real leader in renewable energy, including 'clusters' of renewable energy.

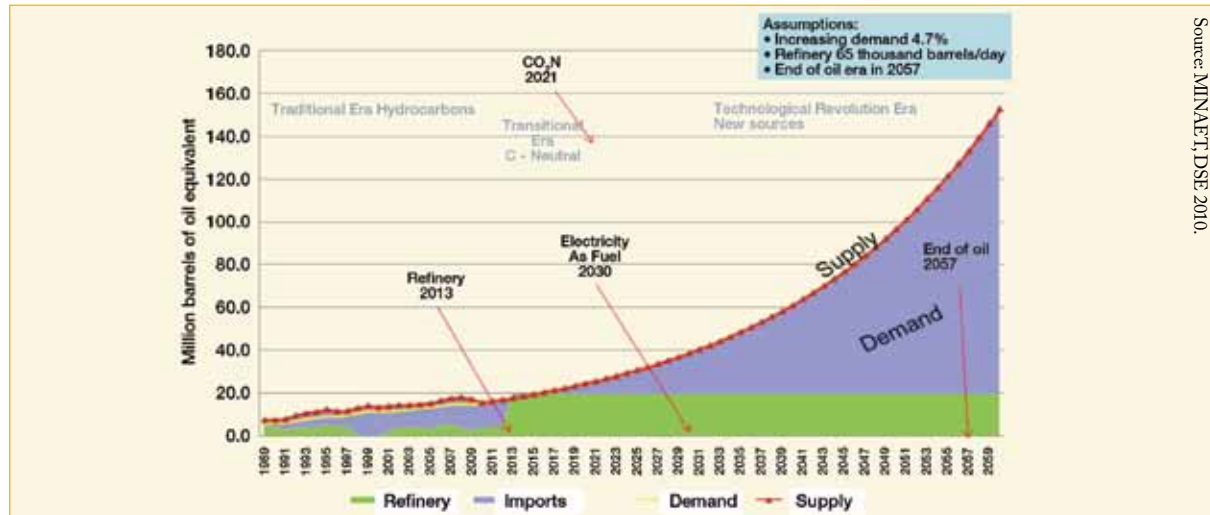
Costa Rica's national energy policy

Costa Rica's proposed national energy policy is based on clear principles of conservation, sustainable development, universality, solidarity, efficiency, competitiveness, innovation, environmental sustainability and participation by both the public and private sectors.

The policy aims to:

- produce clean energy in a sustainable, environmentally friendly way that doesn't impact negatively on human health;
- reduce dependency on imported oil;
- replace imported fossil fuels with domestically generated energy from biodiesel hydroelectric, geothermal, biomass, wind and solar power;
- build an efficient transport system that runs on clean energy;
- achieve high energy efficiency rates;
- reorient energy sector institutions to make them more competitive;

Figure 3. Evolutionary vision of oil and derivatives in Costa Rica.



- promote the use of digital technology to reduce travel and create a more efficient production environment.

To meet future electricity demand, approximately 2,400 megawatts (MW) must be added to the national electricity system over the next decade which involves an investment of about US\$9 billion.

Another major challenge is to reverse the increase in thermal generation, which reached its highest recent level in 2008 (9.2 per cent).

One of the most important tools to address the requirements posed by the proposed strategy is the adoption of legislation that will:

- Adapt the institutional framework of the electricity subsector, clearly defining the objectives, roles and responsibilities of existing institutions and new ones, and clarify the roles of government, regulatory and market agents.
- Create conditions to fully exploit domestic sources of energy and significantly increase their use in electricity generation.
- Meet the requirements for reliable electricity supply from sustainable sources at competitive prices.
- Create a competitive wholesale electricity market with sustainable and effective regulation.
- Create a transparent investment framework that will meet the requirements of the electricity subsector and include a diversity of actors and domestic energy sources.
- Ensure the stability of energy prices and universal distribution.
- Maintain the competencies that currently exist in the electricity subsector.
- Align the national legal framework with the Central American Electricity Market.

New Electricity Law = competition and acceleration of renewables

The new Electricity Law project recently proposed by the Environment ministry is a paradigm shift for the nation's energy market. It would move Costa Rica away from its current monopoly structure towards a competitive

electricity market with emphasis on accelerating the development of renewable energy.

The law will foster competition by creating a strong investment climate for energy companies and promote renewable energy by encouraging private generators to sell their energy directly to regional distributors or heavy energy users, such as industry. Improved grid connection will enable small-scale renewable energy producers to sell their excess power back to the grid.

This proposed new model will help Costa Rica move towards a fully renewable generation and achieve carbon neutrality. In maximising the country's renewable resources, it will improve the environment, boost biomass processing, eliminate thermal plants and promote the protection of watersheds of hydropower projects.

It will also help to ensure that future price rises and shortages of oil do not hit the power generation sector; instead it can accelerate the structural transformation of land transport. In giving long-term financing for generation projects in the coming decades, the sector will have a broad participation across the public and private sectors.

The new law, alongside the multiple energy-saving initiatives and energy efficiency drives, means an energy future for Costa Rica that promises security of supply from a wide range of renewable sources, low or zero carbon emissions and new opportunities for home-grown businesses in a newly competitive energy market.

Teófilo de la Torre Arguello is Head of the Ministry of Environment, Energy and Telecommunications (Minaet) in Costa Rica. Prior to his appointment in March 2010, he was CEO of the ICE. An experienced engineer he is one of Costa Rica's leading energy experts.

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Paseo de la Reforma, Mexico City's most important avenue, has been transformed into a public space for cyclists and pedestrians who go out for a ride on Sundays for the 'Muévete en Bici' programme. Since 2007, around three million people have participated in this activity.



Marcelo Ebrard
Mayor of Mexico City

The battle to slow climate change won't be fought in the world's rainforests nor its oceans but fought – and won – in our biggest cities, says Marcelo Ebrard, current mayor of Mexico City. The health of the planet depends on the actions of billions of urban dwellers. As climate-aware city leaders prove themselves green pioneers, pushing through bold policies to cut carbon emissions and improve sustainability, Ebrard argues that cities should be given a stronger voice in global climate change negotiations.

In spite of the severe potential consequences of global warming, international discussions have been marked by division and disagreement. In 1972, the year in which the UN Conference on the Human Environment officially recognised the impact of human activities on climate, an international negotiation process began that continues today. Almost four decades on, the outlook seems bleak, at least in the short term.

The UN has declared that the actions undertaken by the most industrialised countries have been insufficient to achieve reductions in greenhouse gas (GHG) emissions and that unless substantial efforts are made to mitigate them urgently, changes in climate will become inevitable and irreversible.

In addition, the implementation of clean technologies is not happening fast enough. Faced with this inertia, however, cities have chosen to act. On a daily basis, cities carry out the most relevant and innovative public policies

Green cities – 'state-of-the-art' urban living to tackle global warming

that are already impacting on the world's climate in positive ways.

Cities should have a stronger voice and presence in global climate negotiations given the decisive leadership and commitment of our city's leaders worldwide to mitigate GHG emissions and develop climate change adaptation mechanisms.

Reducing risk for future generations is a priority for the world's cities, therefore the efforts we are making require international support and financing to put the brakes on global warming and reduce the risk profile for the next 20 to 25 years.

Cities to take the initiative

Today, cities at risk from climate-induced flooding, such as London and New York, have expressed their concern about the imminent rise in sea levels. Cities in Asia are concerned about the consequences of increasing numbers of hurricanes every year.

Cities do not have time to waste. We must accelerate the transition to a low-carbon economy by changing habits and investing in environmental protection. We must recognise common responsibilities while differentiating between developed nations and those in the process of development. Cities that do not take the effects of global warming seriously will not be competitive in the future and will generate high risks for their populations over time.

Regional Focus

Metrobus is the Bus Rapid Transit (BRT) system in Mexico City. Its main objective is to improve mobility to prioritise public passenger transport by replacing current buses with a new higher capacity service that will reduce greenhouse gas emissions. At the moment, there are two lines and by 2012 it is scheduled that the Metrobus System will have five transport corridors.



At the Copenhagen Summit (COP15), there were high expectations but little agreement and few are optimistic about securing an international agreement this time round, at the Cancun Summit (COP16). Thus, cities must continue in the fight against climate change, regardless of whether an agreement is reached.

Local leadership and commitment to the planet

Cities have a relevant role in combating the phenomenon of climate change due to their importance in terms of population, economics, and GHG emissions.

It is estimated that cities emit 75 per cent of global GHG emissions. As such, mayors have an important responsibility to make policy and investment decisions aimed at reducing emissions. These include decisions about public transportation and many aspects of energy efficiency, such as street lighting. We can establish incentives for sustainable buildings and issue standards to be applied when managing solid waste and the operation of sanitary landfills.

We are investing a significant part of our budgets in executing climate action strategies and plans. Mexico City will invest over US\$2 billion in its climate programme between 2006 to 2012. These progressive actions place cities in a prominent position in combating global warming, even though mayors are not at the COP negotiating table.

Cities must be acknowledged for the role they play in implementing actions to reduce GHG emissions. At the same time, city governments must attend to community needs when there are emergencies such as floods, fires, or natural catastrophes, many of which can be attributed to the effects of climate change.

The World Mayors Summit on Climate & Mexico City Pact

In this context, we have called mayors in all regions of the world to attend the World Mayors Summit on Climate (WMSC), to be held in Mexico City on November 21 2010. The purpose is to make an appeal to international authorities to recognise the strategic and fundamental role that local governments play in the fight against global warming. As such, we will call for greater access to cooperation, financing, technology and decision mechanisms. We aim to achieve a greater transfer of resources, as well as specific commitments from cities around the world.

The WMSC is organised by the Mexico City government, the World Mayors Council on Climate Change, ICLEI-Local Governments for Sustainability, and by United Cities and Local Governments (UCLG). Collectively, these organisations bring together thousands of cities, authorities, and local governments from around the world.

The WMSC supports a set of previous efforts undertaken by cities and local authorities, such as the signing of the World Mayors and Local Governments Climate Protection Agreement (2007), the Local Government Climate Change Action Plan (2007), the publication of the Copenhagen World Climate Catalogue of City Commitments to Combat Climate Change (2009), Copenhagen Climate Communiqué (2009), the Dunkirk 2010 Call on Climate Action (2010), the Bonn Declaration of Mayors Adaptation Forum (2010), and the C40 Large Cities Climate Summits, among many other efforts.

Our intention is to step up the level of commitment made by cities on the issue of sustainability. We also strive to work together with the UN Framework Convention

The Mexico City Pact

The Pact includes 10 commitments that are subject to review and feedback from the city governments of the world:

1. Voluntarily reducing GHG emissions.
2. Adopting and implementing local climate mitigation measures designed to reach the voluntary emission reduction goals.
3. Developing local adaptation strategies to face the local repercussions of climate change.
4. Registering climate commitments, measures and actions in a quantifiable, reportable, and verifiable (QRV) manner.
5. Promoting the creation of direct access mechanisms to international financing for local climate actions.
6. Establishing a Mexico City Pact Secretariat.
7. Promoting the inclusion of civil society in the struggle against climate change.
8. Promoting and seeking alliances with multilateral institutions and national governments for local climate actions.
9. Promoting alliances and cooperation among cities.
10. Disseminating the message of the Mexico City Pact.

In this way, the Mexico City Pact will become a new international negotiation mechanism and establish a system of measurable and verifiable action reports. This will make it possible to closely follow advances over time and establish criteria and guidelines for assigning funds to local projects.

The WMSC will be a forum for sharing experiences among cities on state-of-the-art policies that have been implemented in regard to energy efficiency, sustainable transport, renewable energy, efficient lighting, generation of electricity from waste, curbing water consumption, and the introduction of electric and hybrid vehicles, among other actions.

The World Mayors Summit on Climate will be an excellent opportunity to achieve a synergy of experiences and agreements. The clearest challenge that we have on the path to COP16 is to receive recognition of our leadership in the struggle against climate change.

on Climate Change (UNFCCC) and the UN COPs, who are coordinating the climate efforts of national governments.

The WMSC will be the basis for signing a voluntary commitment, called the Mexico City Pact. The two-part Pact looks at the strategic role of cities in combating global warming and establishes a set of voluntary pledges to promote strategies and actions to reduce GHG emissions.

Cities are economic and political hubs as well as centres of scientific and technical innovation. As such, cities must be part of the global solution.

In order to track our progress and keep cities accountable, the signatories will register their climate actions in a Carbon Cities Climate Registry (CCCR) created and administered by the Bonn Center for Local Climate Action and Reporting (Carbonn).

This pact will include a call for support from the international community to allocate budget for these actions. In addition, we will work with the World Bank to realise direct funding mechanisms for global warming mitigation initiatives.

Without a doubt, a key outcome of the Mexico City Pact and the first World Mayors Summit on Climate will be the recognition that cities are strategic entities

in mitigating climate change. Cities are economic and political hubs as well as centres of scientific and technical innovation. We have the largest concentrations of population, public goods and investment capital in infrastructure and technical knowledge. As such, cities must be part of the global solution.

Marcelo Ebrard is Head of government of the federal district in Mexico City, the capital of Mexico. He is affiliated with the Party of the Democratic Revolution (PRD) and served as Secretary-General for the former Mexican federal district department, as well as Minister of public security and Minister of social development. He has a degree in international relations from El Colegio de México and specialised in public administration and planning at the École nationale d'administration in France. Since assuming duties as Head of the City Government in December 2006, he has prioritised green transport initiatives including construction of a 12th metro line, new energy efficient vehicles and a tramline.

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CFE: from environmental protection towards a low-carbon electric system

Comision Federal de Electricidad (CFE) is a Mexican state-owned electricity company created by decree in 1937. The company supplies electricity to over 33 million customers in Mexico's industrial, commercial and residential sectors. The company is also responsible for the planning and operation of the country's national electric grid. The ongoing challenge today is how to improve competitiveness and provide cleaner electricity more efficiently.

In 1992, when Mexico signed the Rio de Janeiro Agenda 21 to implement a national sustainability model, CFE's directorate needed a way to make the national electric system a significant contributor, producing electricity using fewer natural resources and reducing air and water pollution.

The company established a principle to identify and address the environmental impacts of all significant operations and make environmental and social responsibility a key part of best management practices. CFE created a specialised entity to co-ordinate efforts and, by the end of 2008, all power plants had their ISO 14000 certificate, demonstrating that comprehensive environmental impact assessments had been carried out at each plant to the guidelines provided by the ISO, the international environmental standards body.

CFE is participating in the self-regulatory framework established by the Federal Government Agency for

Environmental Protection (SEMARNAT). At present 460 of our facilities have been certified as 'Clean Industries'.

Action plans and commitment

At present, the company's philosophy and goals are focused on a greener future, establishing four lines of action in pursuit of sustainability:

- To reduce the environmental and social impacts of major projects and activities;
- To maximise the efficiency in generation, transmission and distribution of electricity;
- To increase the share of renewable energy sources in the electric matrix;
- To promote and sponsor energy-saving programmes.

In the political arena, Mexico's energy sector has undergone important changes. In 1992, the basic regulatory body for the electric sector was modified in such a way as to permit for the first time a partial participation of private investors in the generation field. The figures for self-producer, self-consumer, cogeneration and independent producers were set by law.

These changes contributed to the modernisation of the national electric system and a new approach towards environmental protection. This greater environmental

awareness led to the mandatory environmental screenings of all energy installations. Since then, no plants have been installed without full compliance of the environmental regulations in selecting plant location, water quality and efficient use, soil contamination or air pollution control.

Beyond the mandatory environmental regulations, CFE contributes to reforestation and other forms of environmental reclamation.

By the time Mexico and most of the world's governments signed the Kyoto Protocol, a new challenge had emerged for energy suppliers: the heavy responsibility of the energy sector for global warming. As part of its commitment to prevent an increase in greenhouse gas (GHG) emissions, CFE, as a major participant of the Mexican energy sector, signed an agreement to promote green energy projects in the framework of the Investment and Works Program for the National Electric System.

This commitment was reflected in the Special Program for Climate Change which is a federal document containing all actions to be taken by federal administration entities to combat climate change. The most relevant line of action is to improve energy efficiency in power generation and to increase the share of renewable energy in the energy mix.

CFE has also designed its own internal programme to address climate change, in both mitigation and adaptation. In mitigation, the company is focused on numerous projects to reduce total GHG emissions. In the area of adaptation, vulnerability and sensitivity to climate change are incorporated as key factors in the planning and designing of the national electric system.

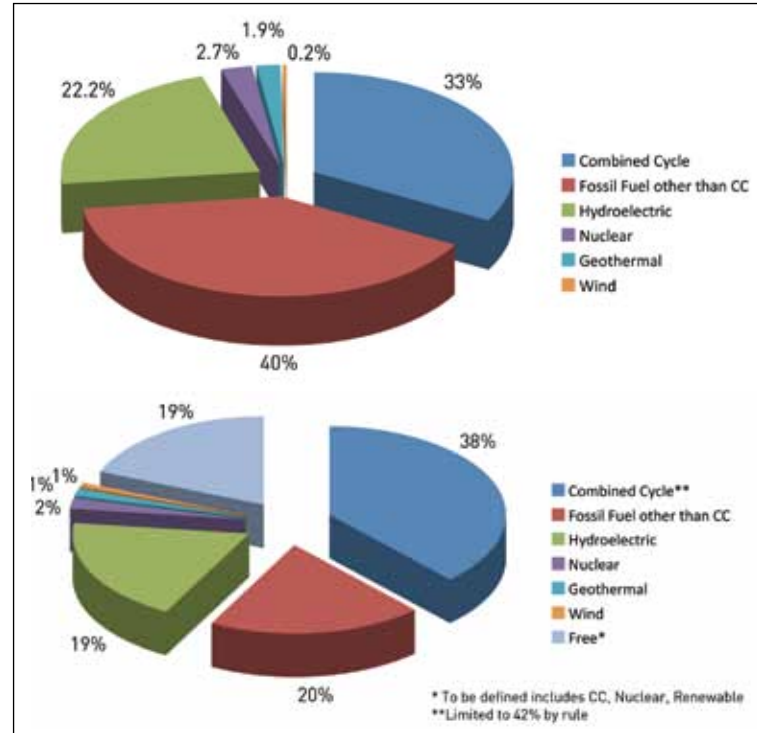
“Mexico is deeply involved in actions to combat climate change.”

To meet its goals, CFE has created two programmes for action planning; one for the short term (up to 2012) and the other long term (up to 2024). In the short-term programme the target is to increase thermal efficiency by an average of two per cent in the national electric system through the modification of the combustion systems, fuel switching and heat recovery.

In this same period, green energy expansion is integrated through the construction and commissioning of a hydraulic generation plant inputting 750 megawatt (MW) to the system, as well as two geothermal plants totalling an additional 50MW. Taking advantage of Mexico's wind potential, CFE has already installed 100MW and has three more wind farms under construction with a combined capacity of 300MW. For the first time ever, a solar concentration field with a 12MW capacity is under bidding process.

Covering both the short- and long-term programmes, the most ambitious project to date is located in the State of Oaxaca in the region called La Ventosa ('the windy area' in Spanish), where CFE, IPP and self suppliers will be installing wind turbines with a combined capacity

Figure 1: 2008 (top); 2024 (bottom)



of 2,500MW. There are 400MW of capacity already in operation and the rest of them will be commissioned from now to the end of 2012.

The long term plan aims to achieve an energy mix that reduces fossil fuel use, from 73 per cent down to a maximum of 60 per cent, with the most probable distribution shown in Figure 1.

International co-operation

Internationally, Mexico is deeply involved in actions to combat climate change. CFE, as part of the Mexican government, is actively participating in the flexibility mechanisms of the Kyoto Protocol. As Mexico is a Non Annex I Country under the Protocol, it is eligible to participate in the Protocol's Clean Development Mechanism (CDM). For CFE, CDM projects represent a huge opportunity to secure extra, non-budgetary funding for environmental actions that will contribute significantly to reducing the country's GHG emissions. Through clean energy projects developed under the CDM, CFE will have made reductions in GHG emissions of more than 2 million tonnes of marketable CO₂ by the end of 2012 as part of a total portfolio of approximately 13 million tonnes over a 10-year period.

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Regional Focus

58 per cent of electricity generated in Latin America and the Caribbean comes from hydropower.



Carlos A. Flórez Piedrahita
Executive Secretary for the Latin American Energy Organisation (OLADE)

Sustainable energy development in Latin America and the Caribbean

In Latin America and the Caribbean, 96 per cent of the total electricity generated comes from just two sources of energy – hydroelectric power (58 per cent), and fossil fuels (38 per cent). Despite the region's great wind, geothermal and solar energy potential, only two per cent of electricity is generated from non-conventional renewable sources. In this context, OLADE can play an important bridging role in stimulating sustainable energy development throughout the region. It is working to establish and strengthen international co-operation on renewable energy projects and to facilitate vital technology transfer.

Within Latin America and the Caribbean, hydropower is the chief source of electricity. The region's total installed capacity for hydropower is 150.4 gigawatts (GW) – of which over half (80GW) is in Brazil. Brazil is one of the world's top hydroelectricity producers: 1,000 of the 1,500 power plants in Brazil are hydroelectric. By contrast, Mexico generates more than 80 per cent of its electricity from fossil fuels and Cuba, with no hydropower plants, generates all its electricity from fossil fuels.

Although many countries in the region are harnessing hydropower for electricity, there is great potential to harness more. Only 23 per cent of hydropower's potential sources are currently being tapped. The principal source of renewable energy and clean electric energy in the region now and in the future will continue to be hydropower. However, there is also great potential to increase the proportion of other renewable energy sources, such as biomass, wind, geothermal and solar.

The four pillars for renewable energy development

There are four essential pillars for the development of renewable energy:

The environment – Greater awareness of the irreversible consequences of CO₂ released by the burning of fossil fuels will serve to promote the use of sustainable, renewable

energy sources and the reduction of CO₂ emissions.

Energy Security – The regional electricity matrix indicates that there is a high dependence on a) fossil fuels and b) hydroelectric systems. Therefore, there is an urgent need to guarantee energy security in the region due to the decreasing global supply of fossil fuels and the dependence on external sources of energy in countries that are not producers of fossil fuels. On the other hand, energy security also depends how vulnerable hydroelectric systems may become due to global warming, the impact on diverse hydrographic sites and their poor management. The need to diversify the energy matrix in the region is imperative.

Economic performance – Conventional, fossil-fuelled forms of electricity generation must be substituted progressively for clean technologies, provided the latter increase their economic and technical efficiency. Efficiency is assessed according to the cost of investment and the energy required for the operation and maintenance of the power plant.

Social inclusion – After a cost analysis, renewable energies are found to be more expensive than their fossil-fuel counterparts but, in reality, they are the ones that stimulate the development of local industries and generate employment, creating greater opportunities and enhancing social inclusion. For example, the biomass sector has a positive impact on social inclusion in the agricultural industry. If we add the internalisation of environmental costs, renewable energy in the long term has great benefits in terms of developing a sustainable economy, society and environment.

Fostering a 'renewables-friendly' environment

If there were greater political will to develop the renewable energy sector, a stimulating environment could be constructed to accelerate the transition. Such an environment would feature a favourable constitutional and regulatory framework, greater fiscal stimulus and institutional capacity, education in renewable energy technology and comprehensive (re)training of local communities.

Support frameworks: It is necessary to point out the close relationship that exists between the development of institutional and legal frameworks and the evolution of renewable energies and energy efficiency in several countries.

Energy efficiency in Latin American and the Caribbean has seen a small improvement as measured by a reduction in energy intensity (a measure that correlates energy use and economic growth). However, such improvements can also be due to the use of more energy-efficient machinery and equipment developed in industrialised countries rather than any long-term energy efficiency programmes.

With all this in mind, the following question arises: is there a close relation between the lack of renewable energies, poor energy efficiency and the institutional framework? The answer is evidentially affirmative. For example, Brazil's amazing expansion of biofuel production which is largely attributed to the development of a strong supporting legal and institutional framework in the country.

“Is there a close relation between the lack of renewable energies, poor energy efficiency and the institutional framework?”

Another example is the jump in energy productivity in Mexico. The National Commission for Energy Efficiency (CONUEE in Spanish), an administrative body within the government's Ministry of Energy, was set up in 2008 specifically to promote energy efficiency and sustainable energy development. Since its creation, the country has significantly increased its homegrown energy production and simultaneously reduced its energy intensity. CONUEE focuses on establishing long-term development programmes which support investments in energy efficiency for long periods, reducing uncertainty and perceived risk.

Regionally speaking, the institutional framework of Latin American and the Caribbean could be improved in great measure by creating networks of all the stakeholders involved in the energy sector, establishing competent institutions and building institutional and technical capacity that would enhance several long-term development programmes.

Technology transfer: The transfer of technology is an important element for reducing vulnerability to climate change. Latin American and the Caribbean are collectively responsible for just five per cent of global CO₂ emissions. The responsibility for cutting emissions, therefore, lies principally on the countries that are part of the Organisation for Economic Cooperation and Development (OECD). Equally, the process of technology transfer, which involves the sharing of practical knowledge, experience and equipment to mitigate climate change, must be initiated by the high-emitting countries through a commitment to helping

less developed countries, small insular states and other vulnerable regions to adapt to the effects of climate change and develop their clean energy technologies.

This support needs the co-operation of all actors involved – private and public companies, individual clients, owners, financing organisations, governments, multilateral and NGOs, among others.

The introduction of technology to tackle climate change in less developed countries will occur as a consequence of long-term programmes of technical cooperation. Such programmes will help strengthen the institutional, legal and financial mechanisms, such as funds, direct external investment and commercial loans.

International co-operation: OLADE is highly sensitised to the urgent global and regional need to secure energy supply in an economically, socially and environmentally sustainable manner. It has established as one of its top priorities within its long-term strategic planning the promotion of clean energies and improved energy efficiency.

OLADE has four key processes that are continually reviewed and improved:

1. Promote and catalyse the sources of renewable energies and energy efficiency
2. Develop adaptation and mitigation strategies for climate change
3. Prevent and mitigate the environmental impacts of the petroleum and electricity sectors.
4. Aid in the transfer of knowledge, the sharing of best practice and networking

OLADE with its institutional capacities, its networks in Latin America and the Caribbean, and its clear long-term objectives, promotes initiatives that will ultimately lead to a genuinely sustainable energy matrix in the region.

Carlos A. Flórez Piedrabita is Executive Secretary for OLADE. He was the National Coordinator of OLADE in Colombia, and became Chairman of the Strategy and Planning Committee within OLADE in 2005 before becoming a member of the Directive Committee.

OLADE is an intergovernmental public organisation created with the formalisation of the Lima Agreement in 1973 and ratified by 26 Latin American and Caribbean Member Countries. OLADE offers political and technical support to its Members to facilitate joint efforts towards regional and sub-regional energy integration. OLADE seeks to contribute to the region's integration, sustainable development and energy security, advising and promoting co-operation and co-ordination among its member countries.

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BIOeCON's innovative, breakthrough technologies

Renewable fuels, energy and chemicals from biomass

BIOeCON develops innovative, cost-effective, environmentally positive technologies for the conversion of non-food biomass into renewable fuels, energy and chemicals.

The privately funded venture draws on an international network of outstanding scientists. In the five years since its formation in the Netherlands Antilles, thanks to its clear vision and a strong focus, BIOeCON has filed more than 50 international patent applications and earned itself a reputation as a biomass-conversion-technology pioneer.



“This important partnership will accelerate the development of second-generation biofuels and increase productivity with better use of agricultural wastes.”

JOÃO NORBERTO NOSCHANG NETO, TECHNOLOGY MANAGER, PETROBRAS BIOFUEL



Three BIOeCON breakthrough technologies are already being scaled up for commercial implementation:

- **Biomass catalytic cracking (BCC)** converts waste biomass into fuels and chemical feedstocks using a process related to conventional refinery catalytic cracking. KIOR, a joint venture between Khosla Ventures and BIOeCON, is developing and commercializing BCC technology. At its demonstration plant, the company already produces 15 barrels a day of a crude oil substitute, Re-Crude™, from wood and agricultural waste residues. Because Re-Crude is refined using standard equipment and produces conventional transport fuels, neither new refinery hardware nor new distribution infrastructure is required. This makes the BCC process an economically, as well as environmentally, attractive technology.
- **BiCHEM biomass chemical conversion technology** produces base chemicals from biomass. It uses an inexpensive, recyclable solvent to break down cellulose and hemicellulose into sugars. These sugars are hydrogenated and then converted into base chemicals for producing, for example, environmentally friendly plastics, or transformed into next-generation, advanced fuel additives such as high-cetane biodiesel. BIOeCON is currently working with Petrobras to establish proof of concept at pilot and demonstration scales.

João Norberto Noschang Neto, technology manager, Petrobras Biofuel, says, “This important partnership will accelerate the development of second-generation biofuels and increase productivity with better use of agricultural wastes.”

- **Biomass conversion to electrical power systems (BiCEPS)** is a novel approach to converting solid biomass directly into electrical energy. Biomass-based fuel cells have great potential in South America as alternatives to fossil-fuel-burning power stations for small-scale, decentralized electricity generation.

The future

BIOeCON continues to develop new ideas and is exploring more effective approaches to converting solar energy to biomass, for instance using algae, and converting solar energy directly to liquid fuels (solar-to-fuel).

BIOeCON’s vision for the Caribbean and Latin America

BIOeCON was formed in the Caribbean and has an exciting development partnership with South American energy company Petrobras. The application potential for BIOeCON’s innovative technologies in the Caribbean and Latin America is enormous. The company’s dream is to see existing oil refineries becoming renewable energy plants harnessing algae and using bio-waste conversion technologies to produce fuel, chemicals, energy and clean water.

Further information

Visit: bio-e-con.com

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Mitigating climate change in Chile:

finding solutions together



Chile is working towards reducing its emissions and is keen to address the issue of climate change. Chile's per capita greenhouse gas (GHG) emissions are currently about equal to the world average but the country faces a projected rise in emissions of up to 300 per cent over the next two decades.

Assuming responsibility for climate change in Chile is a key issue, especially given the country's recent accession to the Organisation for Economic Co-operation and Development (OECD). At the same time, Chilean exporters, especially those exporting environmentally sensitive consumer products such as food and timber, have become increasingly aware of the need to reduce the carbon footprint of their products and operations. The positive environmental side-effects from mitigation and carbon sequestration activities are also starting to be better understood and a survey this year revealed that around two-thirds of Chileans would be willing to pay higher prices for electricity from clean energy sources.

The Chilean government has committed to a 20 per cent reduction in CO₂ emissions by the year 2020 against its base line. Studies have also been conducted into the costs of different options for mitigation and the impacts of climate change on different productive sectors. Scenarios have been modelled, economists have utilised tools such as cost-effectiveness analyses, and scientists are identifying a range of the best available mitigation technologies.

However, these actions are only part of the necessary response. For change to materialise and be sustained in the long term there has to be a coherent and consistent national strategy based on the participation of a broad range of actors, private and public, non-governmental, business and academic. Without open, transparent and frank discussion, little genuine transformation will take place.

Six institutions: Empresas Eléctricas, Fundación Chile, Fundación AVINA, Fundación Futuro Latinoamericano, Pontificia Universidad Católica de Chile and Universidad Alberto Hurtado have recognised the need for greater climate change debate and together initiated a round table discussion with a milestone event in November this year.

The initiative, called 'Mitigating Climate Change – effective and efficient solutions' aims to establish a

platform for discussing the measures and instruments proposed to mitigate climate change in Chile. The information should be useful for both the private and public sector and both should be part of the discussions. The measures will be analysed with regard to their cost-effectiveness as well as their technical feasibility, socio-economic and environmental impacts and their potential effects on cultural change.

A steering committee of 30 institutions accompanies the initiative, made up of 11 private companies, four industry associations, four universities and a host of NGOs, public sector and intergovernmental organisations.

First results indicate that there is a wide range of cost-effective measures which have not been implemented due to technical and informational barriers and technological and regulatory lock-ins. Consensus exists around strategic topics such as the need to strengthen the National Agency for Energy Efficiency, a systematic programme of capacity building and the introduction of metrics and measurable goals in different sectors. Taxing CO₂ emissions or developing a 'cap and trade' system are topics that have only recently entered the national discussion but there is general consensus that impact evaluations of these instruments are urgently needed.

The initiative evaluates not only the cost-effectiveness of measures but also their positive social and environmental impacts. Raising energy efficiency in agriculture is particularly attractive in this context, given its positive relation with water efficiency, as are various measures to improve the energy efficiency of housing, through insulation or installing efficient showers.

The measures proposed by the initiative are all technically feasible today and many of these could be implemented with a public-private joint effort urgently. Even then, there is still much to be done: it is estimated that the measures proposed so far represent about one third of the total range of applicable measures using currently available technology.

Website: www.cambioclimaticochile.org



Roca, a leader in sustainability

Roca is a company that designs, produces and sells architectural, building and interior design products for bathrooms. The company is fully Spanish-owned and has 68 production centres. It has a commercial presence in 135 markets across five continents.

Roca works to develop and foster various technologies and initiatives that help protect the environment. This commitment can be seen in our production processes through the Eco-Roca project, in our efforts to develop water-saving products, and in our social projects, such as the recently-launched We Are Water Foundation.

Eco-Roca, the programme that implements our environmental policy in the production centres, has two main goals: firstly, to reduce CO₂ emissions by 25% compared with our 2006 levels by 2014, and secondly, to achieve a manufacturing process without any material waste, through the Zero-Waste programme.

In terms of products, Roca is conducting intensive R&D&I work to develop innovative new concepts that will save water and energy on a daily basis. One of the most important new developments is the launch of W+W. This product combines a basin and toilet in a single unit, which means reducing water usage by up to 50%, as water from the basin is reused for flushing the toilet.

The company's commitment to responsible water use and consumption is intrinsic to our business practice, and is reflected in the We Are Water Foundation, www.wearewater.org. The Foundation's purpose is to mitigate the negative effects of water scarcity or poorly managed water resources, as well as to raise public awareness and encourage people to donate funds towards establishing aid projects.

To this end, the We Are Water Foundation carries out various activities in partnership with several NGOs (UNICEF, Oxfam, Fundación Vicente Ferrer and Education without Borders).

Website: www.roca.com



Renewable energy in Chile

The renewable energy sector in Chile will experience a significant expansion in the coming years, mainly due to modifications in the Electricity Law. These changes have encouraged the development of projects based on non-conventional renewable energy (NCRE) and facilitated access to electricity markets for NCRE projects.

Renewable targets have also been included in the modifications. For example, Law 20.257 of NCRE (2008) states that five per cent of total electricity must be generated from renewable sources by 2010. From year 2015, this percentage should be increased by 0.5 per cent per annum in order to reach a final goal of 10 per cent by 2024. This scenario, coupled with rising prices for conventional fuels has created an increase in renewable energy projects and so Chile is focusing its efforts on its vast potential of renewable resources such as wind, hydro, biomass, solar and geothermal. Local efforts have also recently focused on minimising the barriers for implementing NCRE projects, including; resource information, legal processing, regulatory framework, local infrastructure, credit access, direct-support tools, among others.

Chilean consulting firm, POCH, a specialist in energy infrastructure projects, has been constantly engaged in strategic consulting in this sector, facilitating technology transfer both in Chile and abroad for various renewable energy projects. The experience of POCH is not limited to the execution of studies related to NCRE, however. It has experience across a wide range of activities covering engineering and design, energy services, climate change and technologies, allowing its team to know all stages of the business, including resource exploration, design of technological solutions, environmental research and execution of works, as well as the linkage to environmental markets such carbon emissions reduction. This wide-ranging experience has led POCH to generate an extensive network of diverse stakeholders in Chile and Latin America, and also Europe, North America and Asia.

Website: www.pochcorp.com

CAPTASOL, S.A. DE C.V.
México



Mexico: a country with (renewed) energy!

At the end of the last century, the governments of Mexico envisaged abundant oil supplies for the country long into the future. But today we find ourselves in a very different reality: one where exploration for new oil fields and even the processing of proven reserves has slowed.

Those of us born in the second half of the twentieth century, have wasted fossil energy resources to the point of grave depletion, leaving ourselves and future generations no option but to use what remains efficiently while also recognising the serious risks of burning fossil fuels for our environment and climate.

Yet Mexico, geographically blessed, receives intense sunshine averaging 5kWh/m² every day. Its coastlines stretch for 9,330km while its climate ranges from tropical heat to the sub-zero temperatures of its snowcapped peaks. Combined, these natural riches represent huge potential for developing alternative energy sources, from solar, wind, geothermal, tidal and others.

For many years, the Mexican state has allocated huge sums to subsidising conventional energy. Why not now subsidise our domestic renewable energy industry? New laws and regulations could incentivise the development and use of renewables, helping strengthen a fledgling industry that is of strategic importance to Mexico's future.

Since 1976, Mexican company CAPTASOL has had the greatest number and variety of successful solar applications across all sectors. Its expertise and constant innovation has led to its position as the only Mexican company with more than a dozen invention patents pending before the Mexican Institute of Industrial Property. The company, recognised for its high-tech developments and innovation by national government and NGOs, is working towards a re-energised Mexico and a healthier planet.

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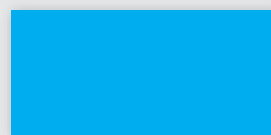
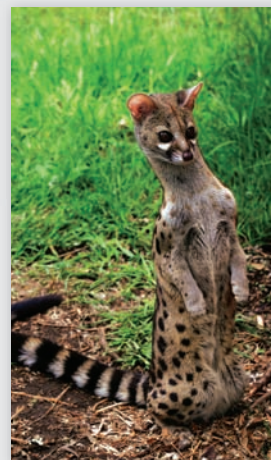
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